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13. ABSTRACT *(Maximum 200 words)*
Disability rates have increased by approximately 10% per year over the past 25 years. Little is known about the etiology, in part because Veterans Administration Schedule for Rating Disabilities (VASRD) codes are not clinical diagnoses. This report describes results from analyses linking VASRD disability codes to International Classification of Disease, 9th Rev., Clinical Modification (ICD-9-CM) clinical diagnoses captured in hospital administrative records during disability case processing. Results suggest that while the primary ICD-9-CM codes generally correspond logically to VASRD codes in the associated disability discharge records, some VASRD categories lack homogeneity, substantially reducing their value for research and surveillance purposes. "Infectious disease, immune disorder, or nutritional deficiency;" "hemic and lymphatic systems;" and "gynecological conditions and disorders of the breast" are either extensively heterogeneous or lack specificity which may result in only partial capture of cases with the same etiology in that particular VASRD group (e.g., breast disorders may logically be placed in more than one VASRD category). Primary clinical conditions experienced by soldiers discharged with "musculoskeletal" disabilities, the most common VASRD disability group, were pain in joint, lumbago, joint derangement, chondromalacia patellae, and osteoarthrosis--all diseases of the musculoskeletal system and connective tissue (ICD-9-CM 710-739). Overall concordance between ICD-9-CM clinical conditions and VASRD codes for "musculoskeletal" disability suggest good face validity. All ICD-9-CM diagnoses associated with the two major VASRD subgroups within "musculoskeletal" disability--"Injury" or "Disease"--fall within the ICD-9-CM 710-739 group suggesting there may be little clinical value in differentiating between "Injury" vs. "Disease." Future efforts should focus on assessing more current VASRD codes and should explore the link between secondary or comorbid clinical conditions and VASRD primary and secondary codes. Future research should explore the etiology of increased risk for musculoskeletal disability, particularly risk factors for lumbago and joint pain-the two most common clinical diagnoses.

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A TALE OF TWO DISABILITY CODING SYSTEMS: THE VETERANS ADMINISTRATION SCHEDULE FOR RATING DISABILITIES (VASRD) VS. DIAGNOSTIC CODING USING THE INTERNATIONAL CLASSIFICATION OF DISEASES, 9TH EDITION, CLINICAL MODIFICATION (ICD-9-CM)

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LIST OF ACRONYMS

ADS	Ambulatory Data System
BMI	Body Mass Index
CRO	Carded for Record Only
DMDC	Defense Manpower Data Center
DOA	Dead on Arrival
DoD	Department of Defense
ER	Emergency Room
ICD-9-CM	International Classification of Disease, 9th revision, Clinical Modification
MEB	Medical Evaluation Board
MEBITT	Medical Evaluation Board Internal Tracking Tool
PASBA	Patient Administration Systems and Biostatistics Activity
PEB	Physical Evaluation Board
TAIHOD	Total Army Injury and Health Outcomes Database
TDRL	Temporary Disability Retired List
VASRD	Veterans Administration Schedule for Rating Disabilities
VA	Veterans Affairs

EXECUTIVE SUMMARY

Disability rates have increased, on average, by approximately 10% per year for the past 25 years (7). Despite dramatic increases in disabilities and the costs associated with them, relatively little is understood regarding their etiology and natural history. In part, this may be due to the fact that the system for coding and describing disability is not clearly linked to medical diagnoses for the underlying clinical conditions. The Army uses the Veterans Administration Schedule for Rating Disabilities (VASRD) system for categorizing and coding permanent disability. This system is primarily focused on describing functional impairment due to a disease or injury. VASRD codes are thus not actual clinical diagnoses. While it is likely that certain patterns of VASRD codes will link directly to certain clinical diagnoses, it is not clear how directly comparable these codes are to the International Classification of Disease, 9th Revision, Clinical Modification (ICD-9-CM) codes used in the U.S. to describe conditions resulting in hospitalizations or outpatient visits. It is also not clear how the VASRD codes will relate to clinical diagnoses and treatment in hospitalizations and outpatient clinics for injuries and diseases occurring prior to, but possibly related to, the disability discharge. Understanding the link between clinical diagnoses and functional impairment codes is essential to identifying risk factors for disability and documenting the natural history of disabling conditions.

This report details findings from our analysis of VASRD disability codes linked to corresponding ICD-9-CM clinical diagnoses from hospital records. The purpose of this report is to clarify and document the association between common VASRD codes and ICD-9-CM clinical diagnoses traditionally used only for inpatient and outpatient medical diagnosis coding.

In order to address the goals of this study, we linked disability discharge case files to a unique set of Army hospital-generated records created at the time of disability discharge. These records do not represent actual hospitalization admissions. They were created under Army administrative directive in order to facilitate the documentation of disability discharges among Army servicemembers. Up until about the year 2000, disability evaluations usually resulted in the generation of one of these administrative hospital records, referred to as “Carded for Record Only” (CRO) records. CRO records include ICD diagnoses based on a clinical review of the information contained in the disability files and are available electronically. While the disability hard copy files also include information on clinical diagnoses, the electronic disability data files do not retain these codes. Thus, without these electronically available CRO files, it would be very difficult to evaluate the clinical significance of VASRD codes on any large-scale basis.

Not all disability cases have these associated administrative records, but a sizable proportion of them do (approximately 1/2 of those during the study period). A comparison of those with a CRO record to those without, among Soldiers discharged with a permanent disability, revealed little difference in the demographic profiles. However, the proportion of disability cases with CRO records did vary somewhat by type of disability, ranging from 22.26% to 52.1% for different types of disability. The

VASRD groups least likely to have a CRO record were those discharged with a mental disorder disability followed by those within the infectious disease, immune disorder, or nutritional deficiency VASRD group. In contrast, disability related to the musculoskeletal system, auditory impairment and organs of special sense, or the respiratory system were most likely to have a CRO record.

We used these CRO records to characterize the clinical significance of the VASRD codes by linking the ICD-9-CM diagnoses listed in the hospital administrative records to the VASRD codes contained in the permanent disability files. VASRD codes may be grouped into 15 broad categories or broken down into increasingly detailed and smaller subcategories within each broad group. Our initial efforts to detail the clinical interpretation of the VASRD codes involved the exploration of commonly assigned ICD-9-CM codes for each of 15 broad VASRD groups. This allows us to better understand the major types of clinical diagnoses associated with overall disability, as well as changes in patterns of disease and injury over time among the entire population of disabled Soldiers. As a second step, we focused on the more detailed codes within the most common VASRD category: musculoskeletal conditions. Because the vast majority of disability is within this group and it is the fastest growing category of disability, it is important to assess the clinical implications of the more specific musculoskeletal VASRD subcategories. Finally, in order to address possible temporal changes in coding, we explore the frequency of top VASRD and top ICD-9-CM coding over time.

For most of the VASRD groupings, the corresponding ICD-9-CM diagnoses demonstrate good face validity. That is, the most commonly assigned ICD-9-CM codes in the hospital-generated CRO disability records do correspond logically to the VASRD codes in the associated disability discharge records. However, some of the VASRD groups lack homogeneity, which substantially reduces their value for research and surveillance purposes. For example, for categories of infectious disease, immune disorder, or nutritional deficiency; hemic and lymphatic systems; and gynecological conditions and disorders of the breast, there is a lot of variation in the types of clinical conditions associated with these broad VASRD groups. This extensive heterogeneity makes these VASRD groups less clinically interpretable and may suggest that aggregate analysis of disability within these groups is less useful for either surveillance or epidemiologic research. For example, the infectious disease, immune disorder, or nutritional deficiency VASRD codes group encompasses infectious diseases, autoimmune processes, and nutritional disorders that often have quite different etiologies. The most common ICD-9-CM diagnosis for this broad VASRD group was HIV infection. This was followed by lupus, an autoimmune disorder, and then by sarcoidosis, a disease with unclear etiology that may have infectious, environmental exposure and/or autoimmune etiology. The diversity of conditions and risk factors for the conditions contained in this VASRD group suggest that caution should be used when assessing changes in this VASRD group. Ideally, subgroup analyses should be undertaken for this group, as well as for diseases of the hemic and lymphatic systems and gynecological conditions and disorders of the breast. Like infectious disease, immune disorder or nutritional deficiency VASRD group, the gynecological and breast disorder group is heterogeneous, and ICD-9-CM conditions linked to this VASRD include conditions that may be experienced by men and women. For example,

abdominal pain was the third most common diagnosis. Since this VASRD group is reserved for women, presumably this refers to abdominal pain of pelvic origin. However, it is not obvious where men with abdominal pain would be placed, nor whether or not women with abdominal pain may appear in more than one VASRD group.

Musculoskeletal conditions are the most common cause for permanent disability discharge from the U.S. Army and have been for over two decades. The primary clinical conditions experienced by those hospitalized and ultimately discharged from the Army with a musculoskeletal disability condition were pain in joint, lumbago, joint derangement, chondromalacia patellae, and osteoarthrosis, which are all diseases of the musculoskeletal system and connective tissue (ICD-9-CM 710-739). The two major VASRD subgroups of musculoskeletal condition are "Injury" and "Disease." The ICD-9-CM diagnoses associated with either of these VASRD subgroups all fall within the ICD 710-739 group suggesting that the distinction in the VASRD subcategories for musculoskeletal condition ("Injury" vs. "Disease") may have diminished descriptive significance. However, the overall concordance between ICD-9-CM clinical conditions and VASRD codes for musculoskeletal disability suggest good face validity.

Musculoskeletal conditions are not only the most common reason for permanent disability discharge, they have been steadily increasing as a proportion of all disability discharges. Respiratory conditions, primarily associated with an asthma-related ICD-9-CM diagnosis, are also increasing as a proportion of the total disability cases.

Future research should explore the etiology of the increased risk for musculoskeletal disability and, in particular, risk factors for lumbago and joint pain—the two most common clinical diagnoses associated with this rapidly growing cause of disability. Specifically, risk factors for back- and knee- or other joint-related disability should be explored. The increased risk for these conditions may reflect changes in the vulnerability of the general population from which the Army draws its employees (e.g., decreased physical fitness in the general U.S. population) and concurrent increased BMI and higher body fat among Army recruits, or it could reflect changes in occupational exposures in the Army. For instance, some occupational specialties now must bear a great deal of equipment weight while marching or walking. Pilots now have greater head-supported mass due to greater ballistics head protection combined with specialty tools (e.g., night vision). All of these could contribute to increasing musculoskeletal disability. Finally, changes in health-seeking behaviors or disability evaluation seeking behaviors and/or changes on the part of providers and disability coordinators could result in changes in overall risk for certain conditions. All of these explanations require greater investigation in order to better understand and describe the underlying reasons for increased musculoskeletal disability.

Consideration from a policy perspective should be given to revising specific VASRD codes and the content of several groupings, such as infectious diseases, immune disorders, or nutritional deficiencies; diseases of the hemic and lymphatic system; and gynecological conditions and disorders of the breast, to improve

homogeneity and, therefore, interpretability of changes in frequencies or rates of disabilities within each of these groups.

INTRODUCTION AND BACKGROUND

Disability is a rapidly growing problem. Disability risk among Army Soldiers has increased seven-fold over the past 25 years. Between 1981 and 2005 the permanent disability discharge rate increased from 178/100,000 population to 1,262/100,000. In 2005 alone there were over 7,000 Soldiers discharged from the Army with a permanent disability (7).

The economic costs of disability to the U.S. military and the Veteran's Administration are shocking. In Fiscal Year 2005 alone, the Department of Defense (DoD) paid disability-retired Army Soldiers nearly half a billion dollars ($474 million) and a total of $1.25 billion in benefits payments to all disabled military service members (2, 9, 33). While total medical care costs for disabled Army Soldiers are unknown, Veterans Affairs (VA) facility treatment costs for Army Soldiers with a medical discharge between 1986 and 1995 were estimated at $124 million in 2001 alone. The cost of running the VA medical system is on the order of 25 billion annually, with most of the care rendered to disabled veterans (2, 34). It seems likely that these costs will only increase once Soldiers with disabilities related to Operation Iraqi Freedom are processed and enter the DoD and VA systems.

Beyond the direct financial cost of disability, there are also substantial indirect costs and non-economic losses that are more difficult to quantify. Disabled Soldiers who leave the work-force prematurely face wage losses among both the disabled individuals and any caretakers. Their quality of life may be diminished. The disabled Soldier may be unable to perform household tasks or manage personal care. The potential decreased quality of life due to the disabling condition is not factored in to the costs of disability (14, 22). Recruitment and replacement training costs, as well as the costs of losing experienced employees, are also not estimated. Also hard to quantify are the costs associated with the Army's investment in training and maintaining Soldiers whose careers are later cut short by a disability. Medical care for the condition prior to disablement and administrative costs associated with evaluating and processing the disability are not well documented.

Despite the dramatic increases in disabilities over time and the costs associated with them, relatively little is understood regarding their etiology and natural history. In part this may be due to the fact that the primary system for coding and describing disability is not clearly linked to the medical care system and to clinical diagnoses. The Army Physical Evaluation Board (PEB), part of the disability evaluation process, uses the Veterans Administration Schedule for Rating Disabilities (VASRD) to categorize and describe disability. While International Classification of Disease, 9th Revision, Clinical Modification (ICD-9-CM) clinical diagnoses related to the disability medical evaluation process, as well as other pertinent medical data, are used by coders to create the disabled Soldier's VASRD code, the PEB electronic disability data file does not include the actual ICD-9-CM clinical diagnoses used by coders to help determine the VASRD code. The VASRD system used to code each type of permanent disability was created to describe functional impairment due to a disease or injury, and thus the VASRD codes

describing a particular Soldier's disability are not actual clinical diagnoses. While it is likely that certain patterns of VASRD codes will link directly to certain clinical diagnoses, it is not known to what extent these codes are comparable to ICD-9-CM codes that are used to describe conditions resulting in hospitalizations or outpatient visits. It is also not clear how these VASRD codes will relate to clinical diagnoses and treatment in hospitalizations and outpatient clinics for injuries and diseases occurring prior to, but possibly related to, the disability discharge.

In order to effectively study the natural medical history of disability and to identify important risk factors and effect modifiers of disability, it is important to understand the clinical significance of the major types of disability. This is not possible without linking the functional impairment codes represented by VASRD broad and specific codes to clinical diagnoses represented by ICD-9-CM codes.

The primary purpose of this report is to illuminate and document the association between major VASRD codes and ICD-9-CM clinical diagnoses. Because there are no electronically available clinical diagnoses in the disability file, we address this aim by linking disability data to a special category of administrative hospital records associated with a large portion of disability cases between 1984 and 1999. These hospital administrative files include ICD-9-CM diagnoses related to the disability evaluation process and allow us to document the patterns of ICD-9-CM primary diagnoses associated with each of the VASRD code groups. A secondary goal of the analyses described in this report is to explore temporal variation in coding patterns. In addition to an overall assessment of the agreement between VASRD codes and logical ICD-9-CM diagnoses, we explore possible temporal changes in coding practices by examining variations over time in ICD-9-CM coding associated with the most frequent VASRD code group (musculoskeletal conditions).

We hypothesize that VASRD groupings are homogeneous and meaningful and that there will thus be strong associations between each of the VASRD groups and a corresponding, logical, ICD-9-CM diagnostic code group. This might be considered evidence of good face validity for the VASRD codes. Failure to document such agreement would suggest that some or all of the VASRD groups are not specific enough to support aggregate analysis and that analysis of broad VASRD groups may lack clinical relevancy. It could also suggest that the VASRD codes themselves ought to be reviewed with careful thought given to either clarifying use of the VASRD codes for different types of disabilities and/or adding or deleting VASRD codes to improve specificity.

METHODS

DATA

The Total Army Injury and Health Outcomes Database (TAIHOD) was developed to provide ready access to research data in order to answer questions related to the health and well-being of active duty and former active duty Army Soldiers (4-6). The TAIHOD, comprised of data from multiple Department of Defense agencies, is regularly updated with new files, error checked, and linked to existing data. Unique identifiers allow for the linkage of the diverse health and demographic data within these files at the level of the individual Soldier. The availability of this linked information in the TAIHOD allows us to explore associations between coded disability type and related hospitalization clinical diagnoses for the entire Army population over a long span of time. The specific TAIHOD components used in this analysis include demographic data from the Army's Defense Manpower Data System (DMDC), Army hospitalization administrative files, and electronic disability board records from the U.S. Army Physical Disability Agency.

Demographic Covariates

Demographic covariates from the DMDC used in this analysis included gender, rank, age, race, marital status, education, and time in service. Age is presented in years, and total time on active duty is presented in months. The DMDC race and ethnicity categories include white, black, Hispanic, Native American/Alaskan Native, Asian/Pacific Islander, and other." Marital status includes single (never-married), married, and previously married (i.e., widowed or divorced). Education is coded as less than high school degree, high school (or degree equivalent), some college, and completed college or above. Rank for enlisted personnel was coded as Junior (E1-E4), Mid-Level (E5-E6) and Senior (E7-E9) and for officers as Warrant Officer (W1-W5), Junior Officers O1-O3, Mid-Level Officers O4-O5 and Senior Officers O6O11.

Hospital Data (ICD-9-CM Diagnoses)

ICD-9-CM diagnoses were obtained from administrative hospitalization records that were often created as part of the disability evaluation process. Hospital-generated records originate in the Individual Patient Data System maintained by the Patient Administration Systems and Biostatistics Activity (PASBA) (http://www.pasba.amedd.army.mil). The hospital-generated ICD-9-CM data used for these analyses are from records created in Military Treatment Facilities (hospitals) and are created in the same Standard Inpatient Data Record format as inpatient hospitalizations, but do not represent actual hospital admissions. Rather these data are from a specially produced administrative record created in order to facilitate surveillance of disability-related discharge from the Army. These records have no direct link to a specific hospital admission to treat a condition. They were created for administrative purposes and are referred to as "Carded for Record Only" or CRO records.

Historically, CRO records were created in order to track hospital patient-care resources used to process disability discharge cases and to facilitate surveillance of other medical events of unique importance or command interest that involved hospital personnel but which were not actually true hospital admissions (e.g., patients who were dead on arrival [DOA], or who died in the emergency room [ER]). Until 1996, CRO records were required on all ER or DOA deaths. Although the CRO record-keeping system was still in use up until 2000, the number of CRO records available began to fall off after a 1996 policy change. It was in that general time period that the Outpatient Ambulatory Data System (ADS) was implemented. Policy-makers believed that the implementation of the electronic ADS system diminished the need to track ER deaths. The ADS, while making available important information, lacks some of the information contained in hospital files, including cause of injury coding. In addition, it does not include information that directly links clinical diagnoses to a specific disability case. Thus, the policy change resulted in a loss of potential data available for research on both causes of injury when the person arrives at the hospital DOA or dies in the hospital ER, and on the clinical diagnoses associated with disability.

While the change in policy limits research on clinical causes of disability after 2000, data up until 2000 provide a robust source of information that may be used for the purposes of this study. CRO records were used to record PEB actions resulting in discharge from service for disability. The information for creation of these CRO records came from review of hard copy Medical Evaluation Board (MEB) and PEB records. The Medical Evaluation Board Internal Tracking Tool (MEBITT) was initiated in 1999 to record details of MEBs, including ICD-9-CM codes (6). While providing an alternate and potentially more robust source of this data than CRO records, the MEBITT data have been criticized because of inaccuracies and reported poor training of the PEB Liaison Officers (10). In addition, they are only available for more recent years. The CRO records are thus an immensely useful though underutilized complementary data source to Army disability agency records and were the most reliable source of disability-related ICD-9-CM diagnosis codes prior to 2001. Although they do not represent true hospital admissions, CRO records provide important clinical information, most importantly ICD-9-CM codes (which are not present in the electronic physical evaluation disability database) and cause-of-injury codes when the diagnosis is an acute injury. Unfortunately, because the recording of the CRO records for tracking disability and other cases was considered superfluous once the implementation of the ADS and the MEBITT systems were completed (1996-2001), CRO records were phased out, thereby eliminating this rich source of information on disability cases after about 2000.

While the CRO files do provide important information not elsewhere available in electronic analyzable format, they are not available on all disability cases. Approximately 1/2 of Soldiers who have been discharged from the Army since 1971 due to disability have CRO records in the hospital database during the years in which CRO records were still being used. It is not clear why some disability cases do not have a corresponding CRO record. One aim of these analyses is to compare the demographic characteristics of disability cases with CRO records to those without to see if this reveals any important patterns or differences between disabled Soldiers with and without CRO records.

Disability Data

Disability data from the U.S. Army Physical Disability Evaluation process derive from two review boards that evaluate a potentially disabled Soldier's medical status. First, the MEB assesses the degree of the Soldier's disability using medical standards (IAW AR 40-501). Second, the PEB assesses the impact of the disability on the Soldier's ability to perform his or her military duties (28) (https://www.perscom.army.mil/tagd/pda/pdapage.htm). These review boards may find a Soldier permanently disabled, or may find that he or she is fit to return to duty. If the Soldier's condition is temporary or unstable, the PEB may assign the Soldier to the Temporary Disability Retirement List (TDRL). TDRL cases are reevaluated at least every 18 months and must be given a final disposition within 5 years. Soldiers on TDRL may differ from those never placed on TDRL. Because the process of evaluation and reevaluation of TDRL cases before final disposition is made can be quite long, we excluded TDRL cases from this analysis (reduces total population by approximately 8%).

Upon completion of the review process, the disabled Soldier may be retired permanently, or separated with or without severance pay. The MEB includes ICD clinical diagnoses, though it does not include the VASRD code, since this is assigned as part of the next step: the PEB process. Some of the clinical information from the MEB is now being collected and maintained in an electronic analyzable form (i.e., MEBITT), but these are only available for 2001 and later and not a current component of the TAIHOD. In addition, as noted above, there are limitations to the MEBITT data. As such, these data are not used in this analysis.

The PEB data include a VASRD code but no clinical ICD diagnoses. The TAIHOD includes all PEB records for the years 1981-forward, with information on dates of disability and the findings of the disability boards (including disability-rating percentages), but these files lack clinical diagnostic data. To overcome this obstacle to comparing the VASRD codes to clinical ICD-9-CM codes, we reviewed data from all available CRO hospitalization records (described above under Hospital Data). CRO hospitalization records include a unique identifier and date and can thus be linked to unique identifiers present in the PEB disability file.

Type of Disability

The VASRD codes are organized into 16 body/organ system groups that may be thought of in a very general sense as causes or major types of disability. These are the following: Musculoskeletal System; Respiratory System; Cardiovascular System; Digestive System; Genitourinary System; Gynecological Conditions and Disorders of the Breast; Hemic and Lymphatic Systems; Skin; Endocrine System; Neurological Conditions and Convulsive Disorders; Mental Disorders; Impairment of Auditory Acuity; Other Sense Organs; Organs of Special Sense (Eye); Infectious Disease, Immune Disorders and Nutritional Deficiencies; Dental and Oral Conditions (Table 1). Due to the relatively small number of "other" sensory organ disability cases, we collapsed disabilities related to the ear with disabilities of "other sense organs" (excluding conditions occurring to the eye) yielding a total of 15 VASRD broad groups. Each of

these broad groupings can be further divided into increasingly more detailed categories and codes. For example, musculoskeletal conditions (the most common VASRD group among permanently disabled Soldiers) actually include 100 sub-codes.

Table 1. The broad classifications for permanent disability currently used by the Army.

38 C.F.R. 4 Subpart B (2006)	Category	Description
§4.71a	Musculoskeletal System	Includes conditions of the upper and lower extremities, inflammatory conditions, joint replacements, fibromyalgia, and spinal disorders.
§4.84a	Organs of Special Sense (Eye)	Includes vision loss, glaucoma, and other eye disorders.
§4.87	Impairment of Auditory Acuity (Ear)	Includes auditory-related disorders such as hearing loss and tinnitus.
§4.87a	Other Sense Organs	Includes loss of smell and taste.
§4.88b	Infectious Diseases, Immune Disorders, Nutritional Deficiencies	Includes infectious disease and immunological compromising disorders such as Lupus, HIV, and Chronic Fatigue Syndrome.
§4.97	Respiratory System	Includes infections, arthritis, and a variety of other systemic disorders.
§4.104	Cardiovascular System	Includes conditions of the heart and vascular system.
§4.114	Digestive System	Includes inflammations and infections, pancreatic disorders, obstructive conditions, and other dysfunctions such as ulcers.
§4.115	Genitourinary System	Includes urinary system problems and kidney disorders.
§4.116	Gynecological Conditions and Disorders of the Breast	Includes gynecological or breast cancer, endometriosis, gynecological diseases, injuries, or removal.
§4.117	Hemic and Lymphatic Systems	Includes anemia, leucopenia, leukemias, and lymphomas.
§4.118	Skin	Includes eczema, psoriasis, and a variety of other dermatological and urticarial disorders.
§4.119	Endocrine System	Includes diabetes, adrenal disorders, and thyroid conditions.
§4.124a	Neurological Conditions and	Includes neurogenic muscular conditions, degenerative disorders, demyelinating

	Convulsive Disorders	disorders, residuals of cardiovascular accidents and traumatic brain injury, seizures, and peripheral nerve dysfunctions.
§4.130	Mental Disorders	Includes most psychiatric conditions except personality disorders and conditions related to substance abuse.
§4.150	Dental and Oral Conditions	Includes tooth and mandible loss.

VASRD codes have sometimes been modified, dropped or new codes added over the study period. Changes do not affect the 15 broad groupings we used, but do affect subcodes within these broader VASRD categories. To simplify our efforts, these analyses rely on only the currently used codes. In the final section of this report, part IV, we explore temporal changes in VASRD coding, as well as underlying ICD-9-CM codes.

STUDY POPULATION: SELECTION OF CASES

DoD Directive 1332.18 defines disability as "Separation from the Military Service by Reason of Physical Disability" (1996). Title 10, U.S. Code, Chapter 61. DoD Directive 1332.18 outlines the requirements and procedures for separations due to a physical disability with the primary requirement being that the Soldier must be unfit to carry out duties of his or her rank, office, or grade due to a physically disabling condition that substantially limits or precludes fulfillment of the purpose of their active-duty employment. Once it is clear that a Soldier's physical or mental health conditions will make their return to active duty unlikely, Soldiers are referred to an MEB. The MEB reviews all available medical and occupational evidence and makes a recommendation regarding the medical fitness of the individual to perform the duties of their military occupational specialty. A second evaluation is then performed by the PEB. The PEB determines whether or not the condition is stable (no further improvement expected). Soldiers with stable disabling conditions are eligible for a permanent disability discharge. Confirmed permanent disabilities with a record of discharge from the Army between 1984-1999 were used for this analysis of VASRD codes. These cases were then matched to the DMDC in order to obtain demographic information. Subjects were required to have a matching DMDC file occurring within 1 year of the disability date. These matching permanent disability cases comprise the initial study population (N=67,410). These cases were then linked to the PASBA hospital files in order to identify matching CRO records. About half (49%, N=33,322) of the overall population had a matching CRO file. Most analyses of VASRD codes are conducted with the 33,322 disability discharged Soldiers who had CRO hospital records.

ANALYSIS

For every Soldier with a permanent disability discharge from the Army, we searched hospital data files and, where available, captured his or her last disability-

related CRO hospital record. Because these analyses support a larger study, the study cohort was first identified in 1981. Moreover, CRO data are generally not available before 1980 and not consistently used before 1984. We began exploring hospital records occurring in 1980 or later in order to improve our ability to capture disability hospital evaluations occurring up to a year prior to the earliest disability case in our study cohort.

Frequency distributions are used initially to describe the proportions of VASRD groups with corresponding CRO records overall and by year. Chi-square analysis is used to compare the demographic profile of disability cases with a CRO record to those without. For some comparisons, odds ratios and corresponding 95% confidence intervals are also reported.

Frequency distributions are also used to describe common ICD-9-CM codes associated with overall VASRD groups and, for musculoskeletal VASRD disabilities, subordinate codes. A final component of the analysis explores variations in the frequency distributions of ICD-9-CM codes associated with specific VASRD codes by era (1984-1989, 1990-1994, 1995-1999).

Most analyses were conducted using SAS versions 8.2 and 9 (SAS Institute, Cary, NC). EpiInfo Version 6 (Centers for Disease Control and Prevention, Atlanta, GA) was also used for assessing odds ratios and exact 95% confidence intervals for select demographic comparisons. All analyses for this project adhere to the policies for the protection of human subjects as prescribed in Army Regulation 70-25, and with the provisions of 45 CFR 46.

RESULTS

PART I. LINKING TO ICD-9-CM CLINICAL DIAGNOSTIC CODES

While not all disabled Soldiers were evaluated in a hospital setting and CRO records are not available for all cases, approximately 50% of Soldiers discharged with a permanent disability between 1981 and 1999, the primary years in which CRO records were generated, did have a CRO record associated with their PEB disability evaluation. These records provide an opportunity to evaluate the link between clinical diagnoses and disability functional diagnostic groupings. Because not all Soldiers receive a CRO record and the system for coding this changed over time, this section reports findings from analyses of temporal changes in the relative proportion of disability cases receiving a CRO, variations across specific types of disability, and it compares the demographic composition of disability cases with CRO to those without.

A. The Proportion of Disability Cases with Corresponding CRO Hospital Records: Exploration of Temporal Variations and Variations Across Specific Types of VASRD Codes

Administrative changes in hospital record keeping practices resulted in a tapering off of available CRO records after 1996. Figure 1 shows the percentage of disability cases with a CRO record by year of disability discharge. It is not clear why the proportion of cases with a CRO record increased during most of the study period. It may be because surveillance was a major reason for maintaining the CRO system and disability rates were increasing during this time period, resulting in greater scrutiny and efforts to improve reporting via CRO records.

Figure 1. Percent of the disability population with a disability-related CRO Hospital Record, 1984-1999

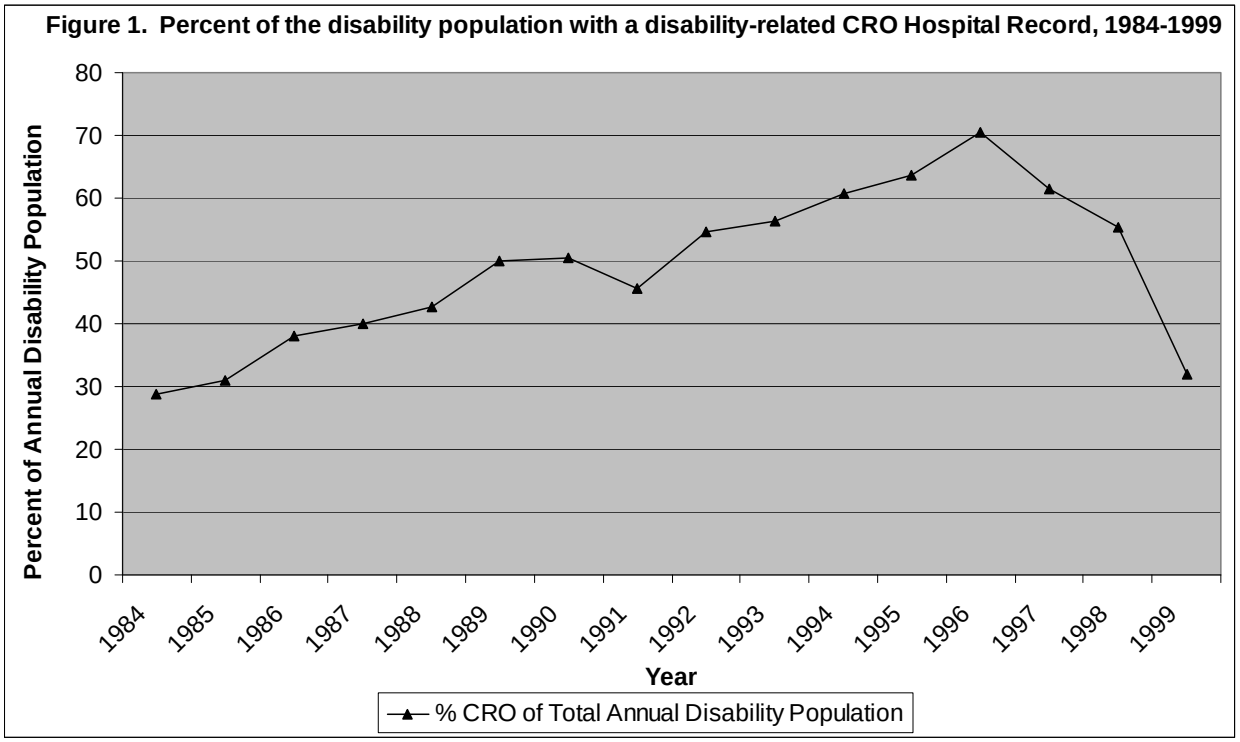


Table 2 shows the proportion of permanent disability cases by major VASRD group with a corresponding matching CRO hospital record. The proportion of disability cases with a CRO record varies somewhat by type of disability, ranging from 22.26% to 52.1%. The VASRD groups least likely to have a CRO record were those discharged with a mental health disorder followed by an infectious disease, immune disorder, or nutritional disease. Musculoskeletal, diseases of the ear and other sensory organs, and respiratory disabilities were all relatively more likely to have an associated CRO hospital record.

Table 2. Proportion of VASRD group with a CRO hospital record associated with a disability evaluation, 1984-1999.

Category	Percent with a CRO Hospital Record
Musculoskeletal system (N=48,120)	52.10%
Ear and other sense organs (N=453)	51.66%
Respiratory system (N=2,646)	47.20%
Skin (N=818)	43.64%
Missing (N=501)	43.31%
Neurological conditions and convulsive disorders (N=4,180)	42.15%
Endocrine system (N=1,309)	41.86%
Eye (N=873)	40.09%
Dental and oral conditions (N=30)	40.00%
Cardiovascular system (N=3,271)	38.80%
Digestive system (N=1,143)	38.15%
Gynecological conditions and breast disorders (N=92)	38.04%
Genitourinary system (N=512)	34.96%
Hemic and lymphatic systems (N=302)	27.48%
Infectious diseases, immune disorders, and nutritional deficiencies (N=545)	26.06%
Mental disorders (N=2,615)	22.26%

B. The Demographic Profile of Disability Cases with CRO Versus Disability Cases Without a CRO Record

Of the 67,410 Soldiers who received a permanent disability discharge between 1981 and 1999, 48.25% (N=32,524) had a prior disability-related hospital record. It is not clear why some disabled Soldiers have a CRO record documenting the evaluation process and why some do not. In order to assess the generalizability of the findings presented in this report, it is important to clarify whether those with a CRO record are similar to those who do not have a CRO record. The results, detailed below suggest that there is little to no difference between Soldiers discharged with a disability who have a CRO record and those discharged with a disability and no CRO record.

Soldiers with CRO records have slightly shorter total time on active service and are slightly though negligibly younger than those without a CRO record at the time of their discharge. The average time in service for disabled Soldiers who do not have a CRO record is 78.9 months (median of 54 months with a range of 420) compared to 74.8 months (median of 54 months with range of 420) for those with a CRO. The mean age for Soldiers without a CRO record was 27.8 (median=26), and the mean age for those with a CRO record was 27.4 (median=26) (data not shown).

Tables 3-4 below display results from Chi-square analysis of nominal demographic variable comparisons between Soldiers with and without CRO records.

Table 3 displays racial and ethnic differences. Large samples result in statistically significant differences between the groups, though actual differences in proportions are nearly negligible.

Table 3. Racial and ethnic composition of Soldiers discharged with a permanent disability between 1984-1999, stratified by presence of CRO record for disability evaluation.

Frequency	No CRO N=34,858 (Column %)	Yes CRO N=32,508 (Column %)	Total N=67,366 (%)
White	23674 (67.9%)	22095 (68.0%)	45,769 (67.9%)
Black	8402 (24.1%)	7976 (24.5%)	16,378 (24.3%)
Hispanic	1351 (3.9%)	1147 (3.5%)	2,498 (3.7%)
Indian/Alaskan Native	222 (0.6%)	168 (0.5%)	390 (0.6%)
Asian/Pacific Islander	467 (1.3%)	412 (1.3%)	879 (1.3%)
Other	742 (2.1%)	710 (2.2%)	1,452 (2.2%)

Chi-square=11.88, p<.05. Frequency missing=44.

As Table 4 below describes, there is little difference between the educational attainment of CRO and non-CRO disability cases. CRO cases were slightly more likely to have a high school degree or equivalent, but slightly less likely to have either less than a high school degree or some college education, or a college degree than non-CRO cases.

Table 4. Educational attainment of Soldiers discharged with a permanent disability between 1984-1999, stratified by presence of CRO record for disability evaluation.

Frequency	No CRO N=34,645 (Column %)	Yes CRO N=32,375 (Column %)	Total N=66,920 (%)
Less than high school	938 (2.7%)	455 (1.4%)	1,393 (2.1%)
High school or equivalent	28,894 (83.4%)	28.327 (87.8%)	57,221 (85.5%)
Some college	2429 (7.0%)	1729 (5.4%)	4,158 (6.2%)
College degree or greater	2384 (6.9%)	1764 (5.5%)	4,148 (6.2%)

Chi-square=300.1, p<.001. Frequency missing=490.

There were some slight variations in probability of having a CRO record across different levels of occupational rank (Table 5). Lower ranking enlisted were slightly more likely than higher ranking enlisted and officers to have a CRO record. Compared to E1-E4, E7-E9 odds of CRO were 0.65 (95% CI=0.61-0.70), Warrant Officer OR was 0.85 (95% CI=0.71-1.01), O1-O3 OR was 0.79 (95% CI=0.71-0.88), O4-O5 OR was 0.60 (95% CI=0.51-0.72), and O6-O11 was 0.40 (95% CI=0.29-0.56).

Table 5. Distribution of rank for Soldiers discharged with a permanent disability between 1984-1999, stratified by presence of CRO record for disability evaluation.

Frequency	No CRO N=34,876 (Column %)	Yes CRO N=32,523 (Column %)	Total N=67,399 (%)
E1-E4	21,013 (60.3%)	20,307 (62.4%)	41,320 (61.3%)
E5-E6	9,643 (27.7%)	9,434 (29.0%)	19,077 (28.3%)
E7-E9	2,559 (7.3%)	1,610 (5.0%)	4,169 (6.2%)
Warrant Officer	297 (0.9%)	243 (0.8%)	540 (0.8%)
O1-O3	870 (2.5%)	666 (2.1%)	1,536 (2.3%)
O4-O5	356 (1.0%)	208 (0.6%)	564 (0.8%)
O6-O11	136 (0.4%)	53 (0.2%)	189 (0.3%

Chi-square=256.3, p<.001. Frequency missing=11.

Men were slightly more likely than women to have a CRO hospital record (Table 6). Permanently disabled men in the study population were 15% more likely than women (OR=1.15, 95% CI=1.11-1.20) to have a CRO record.

Table 6. Gender of Soldiers discharged with a permanent disability between 1984-1999, stratified by presence of CRO record for disability evaluation.

Frequency	No CRO N=34,865 (Column &)	Yes CRO N=32,500 (Column %)	Total N=67,365 (%)
Male	28,946 (83.0%)	27,608 (85.0%)	56,554 (84%)
Female	5,919 (17.0%)	4,892 (15.1%)	10,811 (16.1%)

Chi-square=46.3, p<.001. Frequency missing=45.

Table 7 shows that married Soldiers and formerly married Soldiers were slightly more likely than single (never married) Soldiers to have a CRO record. Married and

formerly married odds of CRO, compared to single Soldiers, was 1.07 (95% CI=1.04-1.11)

Table 7. Marital Status of Soldiers discharged with a permanent disability between 1984-1999, stratified by presence of CRO record for disability evaluation.

Frequency	No CRO N=34,356 (Column %)	Yes CRO N=31,914 (Column %)	Total N=66,270 (%)
Single (never married)	13,174 (38.4%)	11,726 (36.7%)	24,900 (37.6%)
Married	19,733 (57.4%)	18,794 (58.9%)	38,527 (58.1%)
No longer married	1,448 (4.2%)	1,394 (4.4%)	2,842 (4.3%)

Chi-square=19.2, p<.001. Frequency missing=1,141.

PART II: THE ASSOCIATION BETWEEN MAJOR VASRD GROUPS AND ICD-9-CM CLINICAL DIAGNOSES

In order to evaluate the clinical relevancy of a VASRD diagnosis, primary ICD-9-CM diagnoses from CRO records are linked to the VASRD code for each permanently disabled Soldier with a CRO record. The following tables, figures, and results focus exclusively on just the 32,524 permanent disability discharge cases with a matching CRO record. Tables 8a-8o display the top ten primary ICD-9-CM diagnoses associated with each major VASRD group among those cases that had an associated CRO record, respectively. The relative proportion of cases with that particular ICD-9-CM diagnosis is also provided.

A. Most Frequent ICD-9-CM Diagnoses Within Each of the 15 Major VASRD Groups

The ICD-9-CM diagnoses most often associated with VASRD musculoskeletal conditions are displayed in Table 8a . All of the top ICD-9-CM diagnostic conditions for this VASRD group fall within the “Diseases of the Musculoskeletal System and Connective Tissue” (710-739) ICD-9-CM Codes. Six out of the top ten diagnoses fall specifically within “Arthropathies and related disorders“ (710-719).

Joint pain, or arthralgia, was the most commonly assigned primary diagnosis among Soldiers discharged with a musculoskeletal disorder disability VASRD code. Joint pain may result from a number of causes such as trauma, overuse, autoimmune, and other disorders. Arthralgia may be indicative of a number of different underlying clinical conditions including, but not limited to, arthritis, osteoarthritis, gout, fibromyalgia, autoimmune disorders such as lupus, bursitis, tendonitis, and acute injury or trauma (16).

Lumbago, or unspecified low back pain, was the second most commonly occurring ICD-9-CM diagnosis. Two of the top ten conditions are back-related diagnoses, and two are problems related to the knee (pain or injury). Other diagnoses are nonspecific and may also, in some cases, be related to the knee or back. Thus, the total morbidity associated with knee and back problems cannot be fully enumerated.

Table 8a. The 10 most common ICD-9-CM primary diagnoses associated with Musculoskeletal System VASRD Group, 1984-1999.

ICD-9-CM code (number and title)	Frequency	Percent of total*
719.4 Pain in Joint	4,378	17.46%
724.2 Lumbago	3,358	13.40%
718.8 Joint Derangement, Not Elsewhere Classified	1,057	4.22%
717.7 Chondromalacia of Patellae	910	3.63%
715.9 Osteoarthrosis, Unspecified	844	3.37%
729.5 Pain in Limb	762	3.04%
716.1 Traumatic Arthropathy	706	2.82%
717.8 Other Internal Derangement of Knee	621	2.48%
722.1 Displacement of Thoracic or Lumbar Intervertebral Disc w/o Myelopathy	613	2.45%
733.1 Pathological Fracture	530	2.11%

* Percents are given out of the total number of musculoskeletal system disability cases with a disability-related CRO hospital record (N=25,069).

Table 8b displays ICD-9-CM diagnoses most commonly associated with a neurological disability. Epilepsy (ICD-9-CM code 345) was the most common diagnosis comprising at least 7.6% of the total neurological disability cases with a prior hospitalization (ICD-9-CM codes 345.9 and 345.1), followed by migraine with 5.3%.

Table 8b. The 10 most common ICD-9-CM primary diagnoses associated with Neurological Conditions and Convulsive Disorders VASRD Group, 1984-1999.

ICD-9-CM code (number and title)	Frequency	Percent of total*
346.9 Migraine, Unspecified	94	5.33%
780.3 Convulsions	86	4.88%
608.9 Unspecified Disorder of Male Genital Organs	84	2.77%
345.9 Epilepsy, Unspecified	77	4.37%
789.0 Abdominal Pain	75	4.26%
784.0 Headache	65	3.69%
345.1 Generalized Convulsive Epilepsy	56	3.18%
355.8 Mononeuritis of lower limb, Unspecified	48	2.72%
354.2 Lesion of Ulnar Nerve	46	2.61%
355.3 Lesion of Lateral Popliteal Nerve	36	2.04%

* Percents are given out of the total number of neurological condition and convulsive disorder disability cases with a disability-related hospital record (N=1,762).

Table 8c displays the most common ICD-9-CM diagnoses associated with cardiovascular system disability. The majority of cardiovascular disability cases were diagnosed with arteriosclerotic heart disease (414.0, 414.9) (21% of all the top ten cardiovascular disability cases have one of these two clinical diagnoses). Most cardiovascular disability cases have a corresponding ICD-9-CM diagnosis that is consistent with cardiovascular disease. However, the second and third most common diagnoses for Soldiers ultimately discharged with primary VASRD code of cardiovascular disability were actually related to neurological and/or musculoskeletal disorders.

Table 8c. The 10 most common ICD-9-CM primary diagnoses associated with Cardiovascular System VASRD Group, 1984-1999.

ICD-9-CM code (number and title)	Frequency	Percent of total*
414.0 Coronary Atherosclerosis	228	17.97%
733.1 Pathological Fracture	121	9.54%
443.0 Raynaud's Syndrome	75	5.91%
729.5 Pain in Limb	74	5.83%
733.9 Other and Unspecified Disorders of Bone and Cartilage	58	4.57%
414.9 Chronic Ischemic Heart Disease, Unspecified	35	2.76%
453.8 Venous Embolism and Thrombosis of Other Specified Veins	29	2.29%
401.9 Essential Hypertension, Unspecified	27	2.13%
782.0 Disturbance of Skin Sensation	24	1.89%
429.2 Cardiovascular Disease, Unspecified	22	1.73%

* Percents are given out of the total number of cardiovascular system disability cases with a disability-related CRO hospital record (N=1,269).

The vast majority of respiratory-related disability is attributable to asthma (Table 8d). Unspecified and extrinsic asthma (493.9 and 493.0) together describe 67% of the top ten respiratory disability cases.

Table 8d. The 10 most common ICD-9-CM primary diagnoses associated with Respiratory System VASRD Group, 1984-1999.

ICD-9-CM code (number and title)	Frequency	Percent of total*
493.9 Asthma, Unspecified	707	56.61%
493.0 Extrinsic Asthma	131	10.49%
135 Sarcoidosis	42	3.36%
496 Chronic Airway Obstruction, NEC	37	2.96%
518.8 Other Diseases of Lung	30	2.40%
519.1 Other Diseases of the Trachea and Bronchus. NEC	30	2.40%
780.5 Sleep Disturbances	16	1.28%
786.0 Dyspnea and respiratory abnormalities	15	1.20%
786.5 Chest Pain	15	1.20%
519.9 Unspecified disease of respiratory system	14	1.12%

* Percents are given out of the total number of respiratory disability cases with a disability-related CRO hospital record (N=1,249).

Table 8e describes the most common ICD-9-CM diagnoses associated with mental-health-related VASRD disability codes. The most common diagnoses, as a group, are those related to affective psychoses. At least 21% of all mental health disability may be attributable to affective psychoses (ICD-9-CM diagnoses 296.2, 296.3, 296.4, 296.6). This is followed, in frequency, by adjustment reactions and hysteria, 7.39% and 4.98%, respectively.

Table 8e. The 10 most common ICD-9-CM primary diagnoses associated with Mental Disorder VASRD Group, 1984-1999.

ICD-9-CM code (number and title)	Frequency	Percent of total*
309.8 Other Specified Adjustment Reactions	43	7.39%
296.4 Bipolar Affective Disorder, Manic	39	6.70%
296.2 Major Depressive Disorder Single Episode	38	6.53%
296.3 Major Depressive Disorder, Recurrent Episode	30	5.15%
300.1 Hysteria	29	4.98%
295.3 Paranoid Schizophrenia	22	3.78%
310.2 Post-concussion Syndrome	19	3.26%
781.9 Nervous/Musculoskeletal System, NEC	17	2.92%
211 Depressive Disorder, NEC	16	2.75%
296.6 Bipolar Affective Disorder, Mixed	15	2.58%

* Percents are given out of the total number of mental disorder disability cases with a disability-related CRO hospital record (N=582).

Table 8f shows the ICD-9-CM clinical diagnoses most commonly associated with endocrine system disability discharges. Diabetes is the most commonly diagnosed endocrine disorder with diabetes mellitus, without complication, describing over half of all endocrine disability (57%). The combination of diabetes mellitus without complication, with unspecified complication, with ketoacidosis, with ophthalmic, neurological, renal or other manifestations, and with peripheral circulatory disorders together explain or describe 87% of the most common endocrine disorder disability cases.

Table 8f. The 10 most common ICD-9-CM primary diagnoses associated with Endocrine System VASRD Group, 1984-1999.

ICD-9-CM code (number and title)	Frequency	Percent of total
250.0 Diabetes Mellitus w/o Mention of Complication	313	57.12%
250.9 Diabetes with Unspecified Complication	92	16.79%
250.1 Diabetes with Ketoacidosis	23	4.20%
250.6 Diabetes with Neurological Manifestations	16	2.92%
250.5 Diabetes with Ophthalmic Manifestations	13	2.37%
250.8 Diabetes with Other Specified Manifestations	9	1.64%
255.4 Corticoadrenal Insufficiency	8	1.46%
250.7 Diabetes with Peripheral Circulatory Disorders	6	1.09%
992.0 Heat Stroke and Sunstroke	5	0.91%
250.4 Diabetes with Renal Manifestations	4	0.73%

* Percents are given out of the total number of endocrine system disability cases with a disability-related CRO hospital record (N=548).

Table 8g displays ICD-9-CM codes associated with digestive system disability codes. The most common clinical diagnosis associated with a digestive system disability discharge code is regional enteritis. Regional and ulcerative enteritis (555.9 and 555.0, respectively) comprised nearly 17% of the most common digestive system disability clinical diagnoses.

Table 8g. The 10 most common ICD-9-CM primary diagnoses associated with Digestive System VASRD Group, 1984-1999.

ICD-9-CM code (number and title)	Frequency	Percent of total*
555.9 Regional Enteritis, Unspecified Site	59	13.53%
789.0 Abdominal Pain	28	6.42%
556 Ulcerative Colitis	26	5.96%
625.9 Unspecified Symptom Associated with Female Genital Organs	24	5.50%
564.1 Irritable Bowel Syndrome	18	4.13%
571.4 Chronic Hepatitis	18	4.13%
555.0 Regional Enteritis, Small Intestine	14	3.21%
556.0 Ulcerative (Chronic) Enterocolitis	13	2.98%
577.1 Chronic Pancreatitis	12	2.75%
530.1 Esophagitis	11	2.52%

* Percents are given out of the total number of digestive system disability cases with a disability-related CRO hospital record (N=436).

Table 8h describes clinical diagnoses associated with eye-related disability. The particular disorders that may result in eye disability vary substantially, though all of the top ten fall within the ICD-9-CM list of disorders of the eye and adnexa (360-379), rather than eye-related injury (ICD-9-CM codes 870-871.9) or other possible eye-related clinical diagnoses.

Table 8h. The 10 most common ICD-9-CM primary diagnoses associated with Eye VASRD Group, 1984-1999.

ICD-9-CM code (number and title)	Frequency	Percent of total*
362.7 Hereditary Retinal Dystrophies	30	8.57%
360.8 Other Disorders of the Globe	21	6.00%
368.2 Diplopia	18	5.14%
369.6 Profound Impairment, One Eye	17	4.86%
379.3 Aphakia and Other Disorders of Lens	17	4.86%
365.1 Open-angle Glaucoma	15	4.29%
361.0 Retinal Detachment with Retinal Defect	11	3.14%
369.7 Moderate or Severe Impairment, One Eye	11	3.14%
368.0 Amblyopia ex Anopsia	10	2.86%
377.3 Optic Neuritis	10	2.86%

* Percents are given out of the total number of eye disability cases with a disability-related CRO hospital record (N=350).

Scar conditions and fibrosis of the skin (Table 8i) was the most common ICD-9-CM clinical finding among Soldiers discharged with a skin disorder disability (709.2, 13.45%). Five of the top ten ICD-9-CM diagnoses were from the "other inflammatory conditions of skin and subcutaneous tissue" (690-698) portion of the ICD-9-CM codebook. These five conditions (other atopic dermatitis and related conditions, contact dermatitis and other eczema unspecified, other psoriasis, dermatitis due to solar radiation, and dermatitis due to chemical products) were associated with 24% of the most common skin disorder disability cases.

Table 8i. The 10 most common ICD-9-CM primary diagnoses associated with Skin VASRD Group, 1984-1999.

ICD-9-CM code (number and title)	Frequency	Percent of total*
709.2 Scar Conditions and Fibrosis of Skin	48	13.45%
691.8 Other Atopic Dermatitis and Related Conditions	25	7.00%
692.9 Contact Dermatitis and Other Eczema, Unspecified	25	7.00%
696.1 Other Psoriasis	17	4.76%
705.8 Other Specified Disorders of Sweat Glands	14	3.92%
757.3 Other Specified Anomalies of Skin	11	3.08%
692.7 Dermatitis due to Solar Radiation	10	2.80%
692.4 Dermatitis due to Other Chemical Products	9	2.52%
701.4 Keloid Scar	9	2.52%
701.1 Keratoderma, Acquired	8	2.24%

* Percents are given out of the total number of skin disability cases with a disability-related CRO hospital record (N=357).

Table 8j describes the ICD-9-CM clinical diagnoses associated with infectious diseases, immune, and nutritional disability codes. HIV infection was the single most common ICD-9-CM diagnosis associated with this broad VASRD group. In contrast to HIV, an infectious disease, the second, third, and fifth most common diagnoses (systemic lupus erythematosus [13%], unspecified myalgia and myositis, and Systemic sclerosis) all fall within the diseases of the musculoskeletal system and connective tissue (710-739) portion of the ICD-9-CM codebook. The fourth and sixth most common diagnoses for this VASRD group are also within the infectious disease ICD-9-CM category.

Table 8j. The 10 most common ICD-9-CM primary diagnoses associated with Infectious Disease, Immune Disorder, Nutritional Deficiency VASRD Group, 1984-1999.

ICD-9-CM code (number and title)	Frequency	Percent of total*
042 Human Immunodeficiency Virus	31	21.83%
710.0 Systemic Lupus Erythematosus	19	13.38%
729.1 Myalgia and Myositis, Unspecified	12	8.45%
135 Sarcoidosis	9	6.34
710.1 Systemic Sclerosis	6	4.23%
112.0 Candidiasis of Mouth	5	3.52%
780.7 Malaise and Fatigue	5	3.52%
443.0 Raynaud's Syndrome	3	2.11%
756.8 Other specified anomalies of muscle, tendon, fascia, and connective tissue	3	2.11%
785.6 Enlargement of Lymph Nodes	3	2.11%

* Percents are given out of the total number of infectious disease, immune disorder, nutritional deficiency disability cases with a disability-related CRO hospital record (N=142).

Table 8k describes the most common ICD-9-CM diagnoses associated with genitourinary disorder VASRD codes. Hypertensive renal disease (unspecified) and unspecified disorder of male genital organs were the most common single diagnoses, associated with 9% of the top genitourinary disabilities. Four out of the top ten diagnoses were from the 580-589 ICD-9-CM group, nephritis, nephritic syndrome and nephrosis, within the diseases of the genitourinary system. These four ICD-9-CM diagnoses were associated with 18% of all genitourinary disability.

Table 8k. The 10 most common ICD-9-CM primary diagnoses associated with Genitourinary System VASRD Group, 1984-1999.

ICD-9-CM code (number and title)	Frequency	Percent of total*
403.9 Hypertensive Renal Disease, Unspecified	16	8.94%
608.9 Unspecified Disorder of Male Genital Organs	16	8.94%
583.9 Nephritis and nephropathy, with Unspecified Pathological Lesion in Kidney	15	8.38%
604.9 Other Orchitis, Epididymitis, and Epididymo-Orchitis, w/o Mention of Abscess	11	6.15%
753.1 Cystic Kidney Disease	11	6.15%
582.1 Chronic Glomerulonephritis, with Lesion of Membranous Glomerulonephritis	9	5.03%
599.7 Hematuria	7	3.91%
189.0 Malignant Neoplasm of Kidney, Except Pelvis	6	3.35%
583.8 Nephritis and Nephropathy, with Other Specified Pathological Lesion in Kidney	5	2.79%
581.1 Nephrotic Syndrome, with Lesion of Membranous Glomerulonephriti	4	2.23%

* Percents are given out of the total number of genitourinary system disability cases with a disability-related CRO hospital record (N=179).

Table 8l describes clinical diagnoses associated with disability codes related to diseases of the ear and other sense organs (excluding eye – Table 8h). Sensorineural hearing loss is by far the most common diagnoses associated with these disabilities. With the exception of the sixth most common diagnoses, all the diagnoses are from diseases of the nervous system and sensory organs, specifically diseases of the ear and mastoid process (ICD-9-CM 380-389). About 4% of the top ten causes of ear and sensory organ disability have a clinical diagnoses of 780.4 (dizziness and giddiness, not associated with ménière's disease) from the "Symptoms, Signs and Ill-Defined Conditions" portion of the ICD-9-CM index. Four of the top ten are codes related to hearing loss (389), and three are codes from ICD-9-CM 386, "Vertiginous syndromes and other disorders of vestibular system."

Table 8l. The 10 most common ICD-9-CM primary diagnoses associated with Ear and other sense organs VASRD Group, 1984-1999.

ICD-9-CM code (number and title)	Frequency	Percent of total*
389.1 Sensorineural Hearing Loss	110	47.01%
389.8 Other Specified Forms of Hearing Loss	19	8.12%
389.9 Unspecified Hearing Loss	19	8.12%
386.0 Meniere's Disease	17	7.29%
389.2 Mixed Conductive and Sensorineural Hearing Loss	11	4.70%
780.4 Dizziness and Giddiness	9	3.85%
386.1 Other and Unspecified Peripheral Vertigo	7	2.99%
388.3 Tinnittus	6	2.56%
386.5 Labyrinthine Dysfunction	4	1.71%
388.1 Noise Effects on Inner Ear	4	1.71%

* Percents are given out of the total number of ear and other sense organ disability cases with a disability-related CRO hospital record (N=234).

Sickle-cell anemia was the most common diagnoses associated with disability codes for diseases of the hemic and lymphatic system (Table 8m). Five of the top ten diagnoses, including sickle-cell anemia, fall within the diseases of the blood and blood-forming organs (280-289) ICD-9-CM diagnostic group. These five clinical diagnoses describe 39% of the top disability related to diseases of the hemic and lymphatic system. Four of the top ten diagnoses fall into malignant neoplasms of lymphatic and hematopoietic tissue (200-208) comprising 14% of all hemic and lymphatic-related diagnoses. This VASRD group, like the infectious, immune, and nutritional disorder disability codes, is quite heterogeneous.

Table 8m. The 10 most common ICD-9-CM primary diagnoses associated with Hemic and Lymphatic Systems VASRD Group, 1984-1999.

ICD-9-CM code (number and title)	Frequency	Percent of total*
282.6 Sickle-Cell Anemia	14	16.87%
282.4 Thalassemias	6	7.23%
286.4 von Willebrand's Disease	6	7.23%
204.0 Acute Lymphoid Leukemia	4	4.82%
205.1 Chronic Myeloid Leukemia	4	4.82%
728.8 Other Disorders of Muscle, Ligament, and Fascia	4	4.82%
286.0 Congenital factor VIII disorder	3	3.61%
287.3 Primary Thrombocytopenia	3	3.61%
200.1 Lymphosarcoma	2	2.41%
201.9 Hodgkins Disease, Unspecified	2	2.41%

* Percents are given out of the total number of hemic and lymphatic systems disability cases with a disability-related CRO hospital record (N=83).

Table 8n displays the most common clinical diagnosis associated with gynecological and breast disability. One-quarter of the top gynecological and breast disability falls within the 625.9 ICD diagnostic group, “unspecified symptom associated with female genital organs.” Typically this refers to pain in the broad ligament, the perineum, ovary, round ligament, uterus, vagina, or vulva (1 142).

Table 8n. The 10 most common ICD-9-CM primary diagnoses associated with Gynecological Conditions and Breast Disorders VASRD Group, 1984-1999.

ICD-9-CM code (number and title)	Frequency	Percent of total*
625.9 Unspecified Symptom Associated with Female Genital Organs	9	25.71%
617.9 Endometriosis, Site Unspecified	6	17.14%
789.0 Abdominal Pain	4	11.43%
614.6 Pelvic Peritoneal Adhesions, Female	3	8.57%
174.9 Malignant Neoplasm of Breast, Unspecified	2	5.71%
611.7 Signs and Symptoms in Breast	2	5.71%
256.4 Polycystic Ovaries	1	2.86%
427.6 Premature Beats	1	2.86%
616.0 Cervicitis	1	2.86%
617.3 Endometriosis of Pelvic Peritoneum	1	2.86%

* Percents are given out of the total number of gynecological conditions and breast disorder disability cases with a disability-related CRO hospital record (N=35).

Temporomandibular joint disorder is the most frequent clinical diagnosis associated with a dental or oral disability. Very low frequency of dental- and oral-related disability cases makes it difficult to draw many conclusions about the link between ICD-9-CM codes and these types of disability (Table 8o).

Table 8o. The 10 most common ICD-9-CM primary diagnoses associated with Dental and Oral Conditions VASRD Group, 1984-1999.

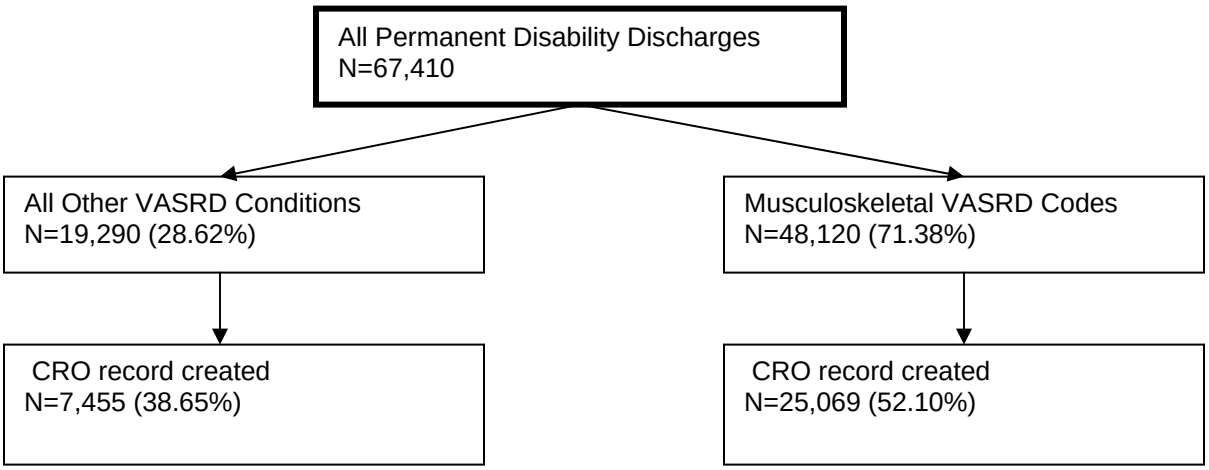
ICD-9-CM code (number and title)	Frequency	Percent of total*
524.6 Temporomandibular Joint Disorder	9	75.00%
524.3 Anomalies of Tooth Position	1	8.33%
715.9 Osteoarthrosis, Unspecified	1	8.33%
728.9 Unspecified Disorder of Muscle, Ligament, and Fascia	1	8.33%

* Percents are given out of the total number of dental and oral disability cases with a disability-related CRO hospital record (N=12).

PART III. FOCUSING ON MUSCULOSKELETAL CONDITIONS

Musculoskeletal disabilities far outnumber other disabilities. 71.4% of all disability conditions among all Soldiers discharged with a permanent disability fall within the musculoskeletal VASRD category (Figure 2). As described in more detail in section I of the results in this report, over half of all musculoskeletal disability cases have a corresponding CRO record. The remainder of this section focuses exclusively on those 25,069 permanent disability cases with both a primary VASRD code of musculoskeletal disability and a linked CRO hospital record.

Figure 2. Musculoskeletal VASRD cases versus all other VASRD cases and available disability-related CRO hospital records, 1984-1999



Because musculoskeletal conditions comprise such a large portion of the total disability population, this section of the report focuses exclusively on this large and rapidly growing group by drilling down to the specific VASRD subcategories of musculoskeletal conditions. These categories become quite numerous and, in some cases, some of the categories are rarely used, so only the most frequently used (populated) categories and subcategories are analyzed.

Musculoskeletal conditions are initially grouped or broken down into one of three categories: Injury, Disease, or Amputation/Prosthetics. An additional small portion (0.3%) of musculoskeletal conditions lack enough detail to place it in one of these subcategories and are thus placed in the “missing” subgroup (Figure 3).

“Injury” is the largest group comprising over 56% of the musculoskeletal disability, followed by Diseases which make up about 43% of cases. Amputation or prosthetics make up a very small portion (0.7%) of musculoskeletal disability and thus are not a focal point for the remaining analyses to investigate ICD-9-CM patterns.

Figure 3. Categories of Musculoskeletal VASRD and available disability-related hospital records, 1984-1999

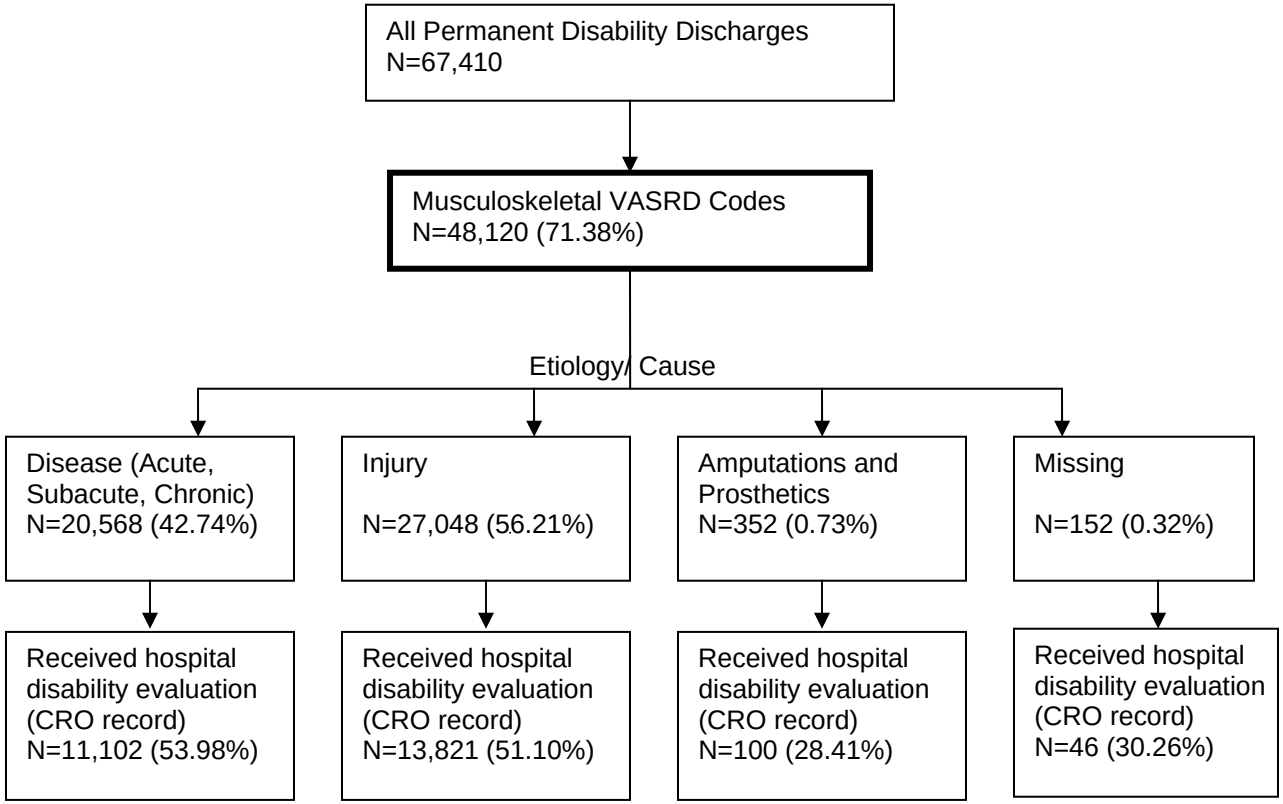


Figure 4 focuses on the largest of the musculoskeletal subgroups – "Injury." "Injury" is further subdivided into either "skeletal" or "muscular" subordinate VASRD groups, with the vast majority of "Injury" disability (97%) falling within the "skeletal" category.

Figure 4. Categories of Musculoskeletal Injury VASRD cases, Muscle versus Skeletal and available disability-related hospital records, 1984-1999

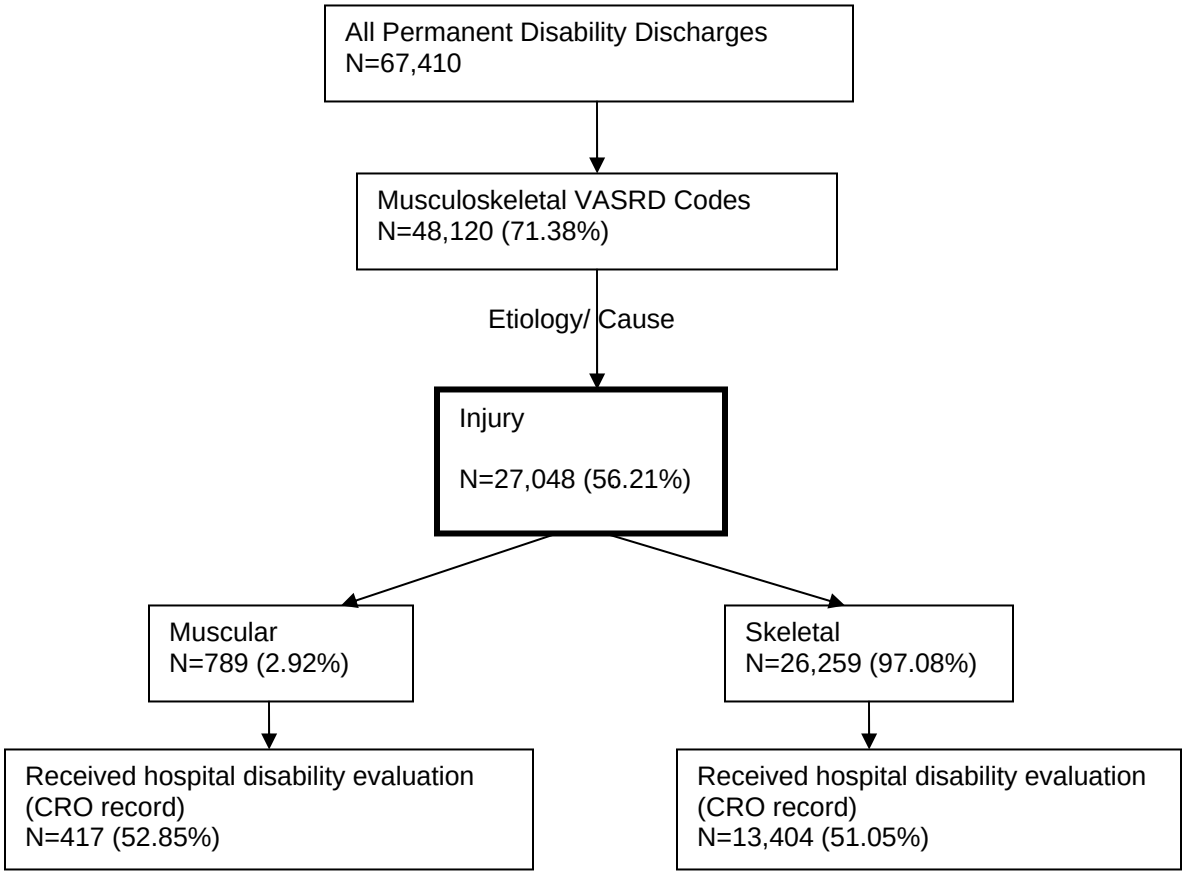


Figure 5 divides the “skeletal” subcategory of the “Injury” group into even smaller subgroups that reflect the body region affected by the condition. Back-related “skeletal Injury” (N=12,911) is the largest category of musculoskeletal disability, comprising 49% of the “skeletal Injury” and almost 27% of all musculoskeletal disability. This is followed by “skeletal Injury” involving the leg, which comprises 43% of all “skeletal Injury” and 23% of the total musculoskeletal disability group.

Figure 5. Subcategories of Musculoskeletal Injury-Skeletal VASRD cases and available disability-related hospital records, 1984-1999

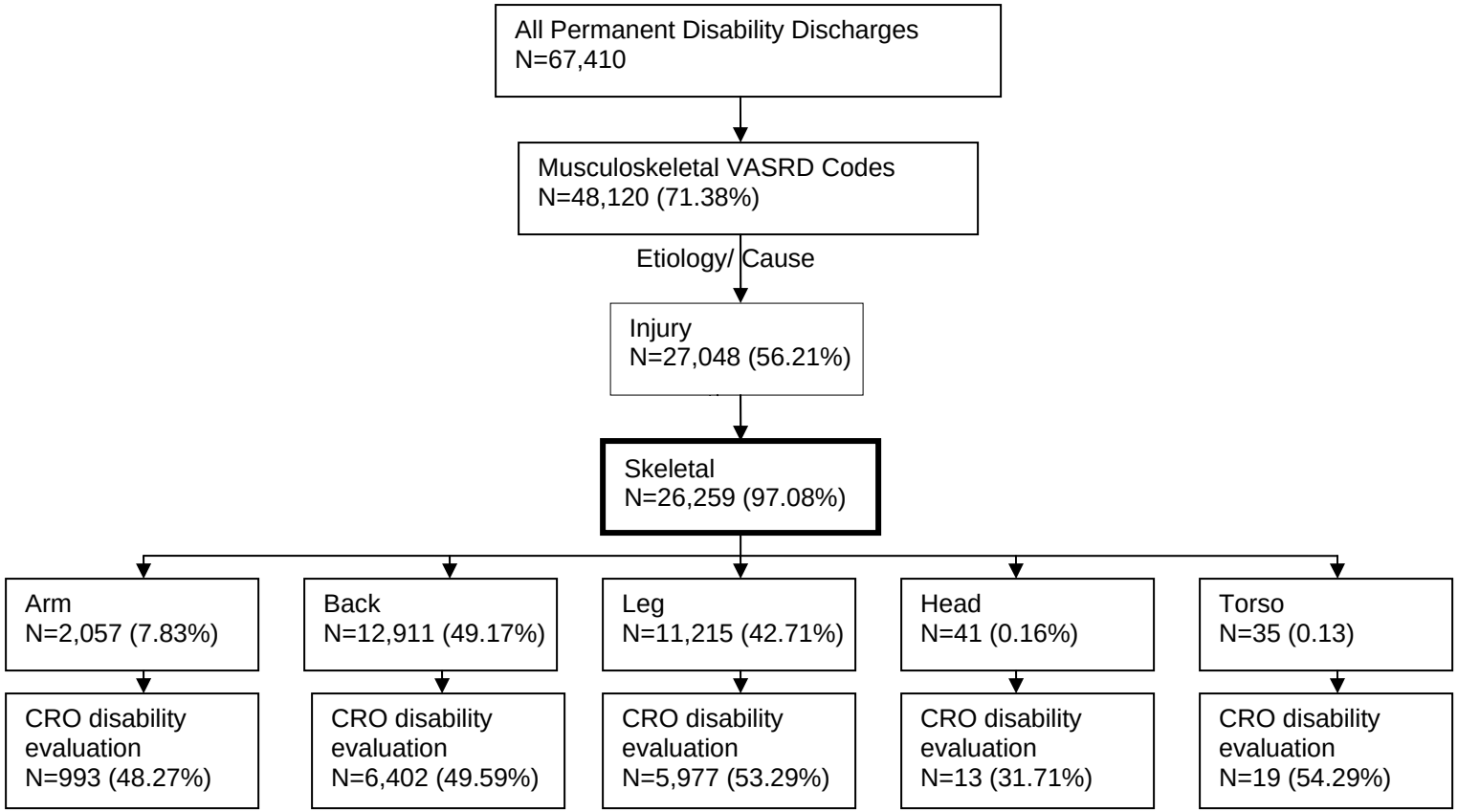
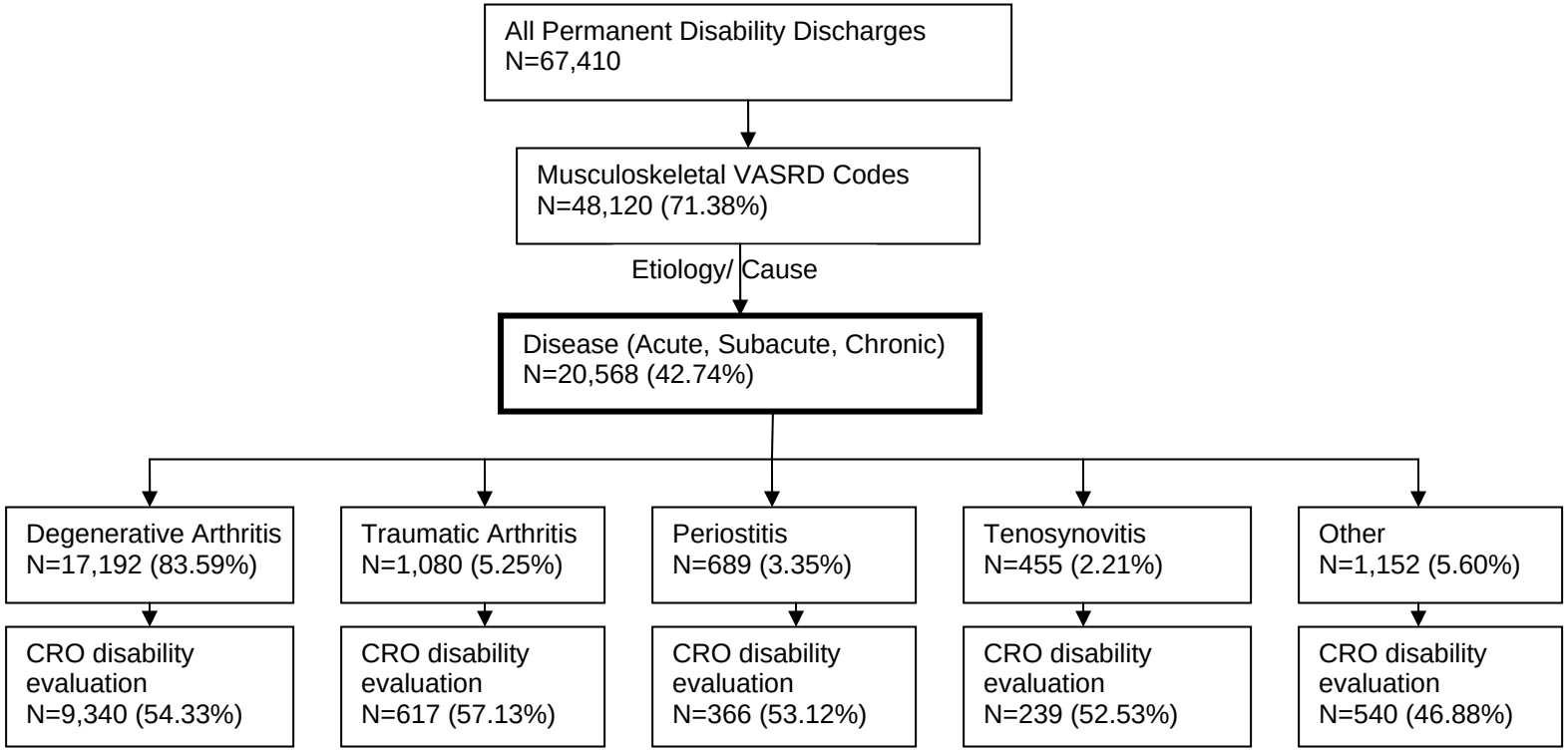


Figure 6 displays musculoskeletal “Disease” disorders, which include arthritis (degenerative and traumatic) and periostitis and tenosynovitis. Degenerative arthritis followed by traumatic arthritis comprise the largest proportion of codes.

Figure 6. Subcategories of Musculoskeletal Disease VASRD cases and available disability-related hospital records, 1984-1999



PROPORTION OF MUSCULOSKELETAL CASES BY SUBCATEGORIES

A. ICD-9-CM diagnoses most frequently associated with the most common specific codes under musculoskeletal conditions

1. ICD-9-CM Conditions Associated with the Major Musculoskeletal Disability Subgroups

The most frequent ICD-9-CM diagnoses associated with a musculoskeletal condition subgrouped as “Injury” include lumbago (22.4%), joint pain (8.9%), and joint derangement (6%). The most frequent ICD-9-CM diagnoses associated with a musculoskeletal condition subgrouped as “Disease” include joint pain (28.3%), chondromalacia of patella (6.8%), and osteoarthrosis (5.3%). Both “Injury” and “Disease” subgroups of musculoskeletal conditions have associated ICD-9-CM diagnoses in the 710-739 range (Diseases of the musculoskeletal system and connective tissue). Thus, the VASRD subgrouping of “Injury” versus “Disease” within the musculoskeletal conditions VASRD group may be somewhat arbitrary, at least with regard to clinical significance. Nearly half of musculoskeletal “Injury” common diagnoses comprised lumbago, pain in joint, pain in limb, osteoarthrosis, other joint disorders and knee-related conditions (total=44.9% for injuries), and 58.3% of musculoskeletal “Disease” were comprised of those conditions (Table 9).

Table 9. 10 most common ICD-9-CM diagnoses within each subgroup of Musculoskeletal VASRD Conditions.

Categories of Musculoskeletal Conditions (N=93,958)	10 Most Common ICD-9-CM Diagnoses	Frequency and Percent
Injury (N=27,048; 13,821 with disability-related hospital record)	724.2 Lumbago	3,090 (22.36%)
	719.4 Pain in Joint	1,220 (8.83%)
	718.8 Joint Derangement, Not Elsewhere Classified	830 (6.01%)
	722.1 Displacement of Thoracic or Lumbar Intervertebral Disc w/o Myelopathy	593 (4.29%)
	734 Flat Foot	577 (4.17%)
	717.8 Other Internal Derangement of Knee	526 (3.81%)
	729.5 Pain in Limb	292 (2.11%)
	722.5 Degeneration of Thoracic or Lumbar Intervertebral Disc	264 (1.91%)
	715.9 Osteoarthrosis, Unspecified	250 (1.81%)
	756.1 Anomalies of Spine	246 (1.78%)

Disease (N=20,568; 11,102 with disability-related hospital record)	719.4 Pain in Joint	3,144 (28.32%)
	717.7 Chondromalacia of Patella	753 (6.78%)
	715.9 Osteoarthrosis, Unspecified	591 (5.32%)
	716.1 Traumatic Artropathy	526 (4.74%)
	729.5 Pain in Limb	460 (4.14%)
	715.3 Local Osteoarthritis, Unspecified	360 (3.24%)
	733.1 Pathological Fracture	354 (3.19%)
	719.8 Other Specified Disorders of the Joint	319 (2.87%)
	724.2 Lumbago	263 (2.37%)
	733.9 Other and Unspecified Disorders of Bone and Cartilage	258 (2.32%)
Amputation/ Prosthetics (N=352; 100 with disability-related hospital record)	736.2 Other Acquired Deformities of Finger	15 (15.00%)
	736.8 Acquired Deformities of Other Parts of Limbs	11 (11.00%)
	729.5 Pain in Limb	10 (10.00%)
	719.4 Pain in Joint	9 (9.00%)
	715.9 Osteoarthrosis, Unspecified	3 (3.00%)
	735.8 Other Acquired Deformities of Toe	3 (3.00%)
	736.7 Other Acquired Deformities of Ankle and Foot	3 (3.00%)
	354.9 Mononeuritis of Upper Limb, Unspecified	2 (2.00%)
	718.4 Contracture of Joint	2 (2.00%)
	727.6 Rupture of Tendon, Nontraumatic	2 (2.00%)
Missing/Unknown (N=152; 46 with disability-related hospital record)	719.4 Pain in Joint	5 (10.87%)
	724.2 Lumbago	5 (10.87%)
	344.0 Quadriplegia and Quadriparesis	3 (6.52%)
	717.7 Chondromalacia of Patella	3 (6.52%)
	715.3 Local Osteoarthritis, Unspecified	2 (4.35%)
	719.8 Other Specified Disorders of the Joint	2 (4.35%)
	728.8 Other Disorders of Muscle, Ligament, and Fascia	2 (4.35%)
	736.8 Acquired Deformities of Other Parts of Limbs	2 (4.35%)
	335.2 Motor Neuron Disease	1 (2.17%)
	344.1 Paraplegia	1 (2.17%)

2. Injury: Muscle or Skeletal

Musculoskeletal disabilities from the "Injury" subgroup are divided into either "skeletal" or "muscular" conditions, with the vast majority (97.1%) falling in the "skeletal" category. The most common ICD-9-CM diagnoses associated with a "skeletal injury" VASRD disability include lumbago, joint pain, and joint derangement. The most common diagnoses among those with a "muscular" condition include fibromatoses, joint pain, and other disorders of muscle, ligament, and fascia. Joint pain appears to be common to many or most of the musculoskeletal disability cases.

When comparing the most common ICD diagnoses between Soldiers who eventually receive a "muscular-related" injury musculoskeletal disability with those who receive a "skeletal-related" injury musculoskeletal disability, the majority of diagnoses in the "skeletal" group (23%) were for lumbago, while 27.1% of the "muscular" group was diagnosed with fibromatoses. Pain in joint and pain in limb were common among both groups. The "muscular" disability group had more muscle-disorder-related hospitalizations, while the "skeletal" group, by far the more common VASRD subgroup, had more back- and knee-related hospitalizations (Table 10).

Table 10. 10 most common ICD-9-CM diagnoses within each subgroup of Injury (within the Musculoskeletal Conditions broad VASRD group).

Categories of Musculoskeletal Injury Conditions (N=27,048; 13,821 with a disability-related hospital record)	**10 Most Common ICD-9-CM Diagnoses**	**Frequency and Percent**
Skeletal (N=26,259; 13,404 with disability-related hospital record)	724.2 Lumbago	3,088 (23.04%)
	719.4 Pain in Joint	1,189 (8.87%)
	718.8 Joint Derangement, Not Elsewhere Classified	825 (6.15%)
	722.1 Displacement of Thoracic or Lumbar Intervertebral Disc w/o Myelopathy	593 (4.42%)
	717.8 Other Internal Derangement of the Knee	526 (3.92%)
	734 Flat Foot	405 (3.02%)
	722.5 Degeneration of Thoracic or Lumbar Intervertebral Disc	264 (1.97)
	729.5 Pain In Limb	264 (1.97%)
	715.9 Osteoarthrosis, Unspecified	249 (1.86%)
	756.1 Anomalies of Spine	246 (1.84%)

Muscular (N=789; 417 with disability-related hospital record)	728.7 Other Fibromatoses	113 (27.10%)
	719.4 Pain in Joint	31 (7.43%)
	728.8 Other Disorders of Muscle, Ligament, and Fascia	31 (7.43%)
	729.5 Pain in Limb	28 (6.71%)
	729.1 Myalgia and Myositis, Unspecified	13 (3.12%)
	728.9 Unspecified Disorder of Muscle, Ligament, and Fascia	13 (3.12%)
	726.7 Enthesopathy of Ankle and Tarsus	11 (2.64%)
	789.0 Abdominal Pain	11 (2.64%)
	734 Flat Foot	9 (2.16%)
	723.1 Cervicalgia	8 (1.92%)

Injury Subgroups: Skeletal. Because the "Skeletal" category comprises 96% of all the musculoskeletal "Injury" conditions, Table 11 focuses just on skeletal injuries. The "Skeletal" category (N=26,259) breaks down disabilities into the following five anatomically derived subgroups: "Arm" (N=2,057, 8%), "Back" (N=12,911, 49%), "Leg" (N=11,215, 43%), "Head" (N=41, 0.2%), "Torso" (N=35, 0.1%). Fifty percent (N=6,402) of those with "back", 53% (N=5,977) of those with "leg," and 48% (N=933) of those with "arm" permanent skeletal disabilities have an associated CRO hospitalization.

Back disabilities comprised 49% of all "Skeletal" disabilities, with ICD-9-CM diagnoses appropriately all falling within the back-related diagnostic group. Anomalies of the spine, a congenital defect, was the only condition in the top ten list that did not fall within the "Diseases of the musculoskeletal system and connective tissue" broad ICD-9-CM group. Leg disabilities were the next largest subgroup of "Skeletal" disability comprising 43%. Approximately 23% of Soldiers with leg-related and a disability-related hospital record had a leg-related diagnosis, but the rest were unspecified conditions. Back- and knee-related disabilities should receive greater study.

Table 11. 10 most common ICD-9-CM diagnoses within each subgroup of Skeletal Injury (within the Musculoskeletal Conditions broad VASRD group).

Categories of Musculoskeletal Skeletal Injury Conditions (N=26,259; 13,404 with a disability-related hospital record)	10 Most Common ICD-9-CM Diagnoses	Frequency and Percent
Back (N=12,911; 6,402 with disability-related hospital record)	724.2 Lumbago	3,063 (47.84%)
	722.1 Displacement of Thoracic or Lumbar Intervertebral Disc w/o Myelopathy	590 (9.22%)
	722.5 Degeneration of Thoracic or Lumbar Intervertebral Disc	264 (4.12%)
	756.1 Anomalies of Spine	245 (3.83%)
	738.4 Acquired Spondylolisthesis	235 (3.67%)
	724.5 Backache, Unspecified	171 (2.67%)
	724.6 Disorders of Sacrum	155 (2.42%)
	7244 Thoracic or Lumbosacral Neuritis or Radiculitis, Unspecified	140 (2.19%)
	722.2 Displacement of Intervertebral Disc, Site Unspecified, w/o Myelopathy	112 (1.75%)
	721.3 Lumbosacral Spondylosis, w/o Myelopathy	96 (1.50%)
Leg (N=11,215; 5,977 with disability-related hospital record)	719.4 Pain in Joint	955 (15.98%)
	718.8 Joint Derangement, Not Elsewhere Classified	662 (11.08%)
	734 Flat Foot	560 (9.37%)
	717.8 Other Internal Derangement of the Knee	523 (8.75%)
	729.5 Pain in Limb	239 (4.00%)
	715.9 Osteoarthrosis, Unspecified	181 (3.03%)
	717.7 Chondromalacia of Patella	153 (2.56%)
	736.7 Other Acquired Deformities of Ankle and Foot	151 (2.53%)
	733.1 Pathological Fracture	148 (2.48%)
	716.1 Traumatic Arthropathy	146 (2.44%)

Arm (N=2,057; 993 with disability-related hospital record)	719.4 Pain in Joint	189 (19.03%)
	718.3 Recurrent Dislocation	155 (15.61%)
	718.8 Joint Derangement, Not Elsewhere Classified	154 (15.51%)
	733.8 Malunion and Nonunion of Fracture	82 (8.26%)
	719.5 Stiffness of Joint, Not Elsewhere Classified	49 (4.93%)
	718.5 Ankylosis of Joint	47 (4.73%)
	726.2 Other Affections of Shoulder Region, Not Elsewhere Classified	41 (4.13%)
	716.1 Traumatic Arthropathy	29 (2.92%)
	715.9 Osteoarthrosis, Unspecified	24 (2.42%)
	729.5 Pain in Limb	16 (1.61%)
Head (N=41; 13 with disability-related hospital record)	724.2 Lumbago	3 (23.08%)
	345.9 Epilepsy, Unspecified	2 (15.38%)
	310.2 Post-concussion Syndrome	1 (7.69%)
	352.9 Unspecified Disorder of Cranial Nerves	1 (7.69%)
	360.8 Other Disorders of Globe	1 (7.69%)
	719.4 Pain in Joint	1 (7.69%)
	734 Flat Foot	1 (7.69%)
	737.3 Kyphoscoliosis and Scoliosis	1 (7.69%)
	738.1 Other Acquired Deformity of the Head	1 (7.69%)
	754.0 Congenital Musculoskeletal Deformities of Skull, Face and Jaw	1 (7.69%)
Torso (N=35; 19 with disability-related hospital record)	733.6 Tietze's Disease	5 (26.32%)
	786.5 Chest Pain	3 (15.79%)
	730.9 Unspecified Infection of Bone	2 (10.53%)
	344.8 Other Specified Paralytic Syndromes	1 (5.26%)
	389.1 Sensorineural Hearing Loss	1 (5.26%)
	701.1 Keratoderma, Acquired	1 (5.26%)
	717.8 Other Internal Derangement of the Knee	1 (5.26%)
	719.4 Pain in Joint	1 (5.26%)
	719.8 Other Specified Disorders of the Joint	1 (5.26%)
	733.2 Cyst of Bone	1 (5.26%)

3. Disease

Investigation of "Disease," the second most common major subcategory of the VASRD Musculoskeletal Conditions following "Injury," reveals more details regarding the types of medical conditions contributing to this rapidly growing category of disability. The four most common conditions within the "Disease" group of musculoskeletal disability comprise over 94% of all musculoskeletal "Disease" disability and include degenerative arthritis, traumatic arthritis, periostitis, and tenosynovitis with degenerative arthritis, followed by traumatic arthritis comprising the largest of these groups (Table 12). For degenerative arthritis the most common specific diagnosis was pain in joint, while the most common diagnosis for traumatic arthritis was traumatic arthropathy. Lumbago (low back pain) was the eighth most common diagnosis among those with a degenerative arthritis disability. The other three categories of musculoskeletal disease disability seem to more often involve disability of the knee or limbs. Of those discharged with a Periostitis disability, only 6% of those with a disability-related hospitalization had an ICD diagnosis for periostitis. More often they were diagnosed with pathological fractures, unspecified disorders of bone and cartilage, and unspecified pain in the joint or limb.

Table 12. 10 most common ICD-9-CM diagnoses within each subgroup of Disease (within the Musculoskeletal Conditions broad VASRD group).

Categories of Musculoskeletal Disease Conditions (N=20,568; 11,102 with disability-related hospital record)	10 Most Common ICD-9-CM Diagnoses	Frequency and Percent
Degenerative Arthritis (N=17,192; 9,340 with disability-related hospital record)	719.4 Pain in Joint	2,394 (31.41%)
	717.7 Chondromalacia of Patella	708 (7.58%)
	715.9 Osteoarthrosis, Unspecified	513 (5.49%)
	729.5 Pain In Limb	404 (4.33%)
	716.1 Traumatic Artropathy	333 (3.57%)
	715.3 Local Osteoarthritis, Unspecified	325 (3.48%)
	719.8 Other Specified Disorders of the Joint	311 (3.33%)
	724.2 Lumbago	245 (2.62%)
	733.1 Pathological Fracture	213 (2.28%)
	718.8 Joint Derangement, Not Elsewhere Classified	207 (2.02%)

Traumatic Arthritis (N=1,080; 617 with disability-related hospital record)	716.1 Traumatic Arthropathy	190 (30.79%)
	719.4 Pain in Joint	81 (13.13%)
	715.9 Osteoarthrosis, Unspecified	73 (11.83%)
	716.9 Arthropathy, Unspecified	34 (5.51%)
	717.7 Chondromalacia of Patella	33 (5.35%)
	715.3 Local Osteoarthritis, Unspecified	32 (5.19%)
	715.2 Osteoarthritis, Localized, Secondary	19 (3.08%)
	717.8 Other Internal Derangement of the Knee	13 (2.11%)
	733.8 Malunion and Nonunion of Fracture	9 (1.46%)
	732.7 Osteochondritis Dissecans	8 (1.30%)
Periostitis (N=689; 366 with disability-related hospital record)	733.1 Pathological Fracture	134 (36.61%)
	733.9 Other and Unspecified Disorders of Bone and Cartilage	76 (20.77%)
	729.5 Pain in Limb	41 (11.20%)
	719.4 Pain in Joint	30 (8.20%)
	733.3 Periostitis	22 (6.01%)
	736.8 Acquired Deformities of Other Parts of Limbs	7 (1.91%)
	844.9 Sprain or Strain, Unspecified Site of Knee and Leg	6 (1.64%)
	719.9 Unspecified Disorder of Joint	4 (1.09%)
	734 Flat Foot	4 (1.09%)
	719.8 Other Specified Disorders of the Joint	3 (0.82%)
Tenosynovitis (N=455; 239 with disability-related hospital record)	714.0 Pain in Joint	51 (21.34%)
	726.7 Enthesopathy of Ankle and Tarsus	43 (17.99%)
	726.6 Enthesopathy of Knee	29 (12.13%)
	727.0 Synovitis and Tenosynovitis	19 (7.95%)
	728.7 Other Fibromatoses	13 (5.44%)
	718.8 Joint Derangement, Not Elsewhere Classified	10 (4.19%)
	726.2 Other Affections of Shoulder Region, Not Elsewhere Classified	7 (2.93%)
	726.9 Unspecified Enthesopathy	7 (2.93%)
	718.3 Recurrent Dislocation	6 (2.51%)
	729.5 Pain in Limb	6 (2.51%)

Other (N=1,152; 540 with disability-related hospital record)	729.1 Myalgia and Myositis, Unspecified	79 (14.63%)
	719.4 Pain in Joint	48 (8.89%)
	726.5 Enthesopathy of Hip	44 (8.15%)
	714.0 Rheumatoid Arthritis	41 (7.59%)
	720.0 Ankylosing Spondylitis	31 (5.74%)
	099.3 Reiter's Disease	30 (5.56%)
	724.2 Lumbago	14 (2.59%)
	723.1 Cervicalgia	12 (2.22%)
	696.0 Psoriatic Arthropathy	10 (1.85%)
	728.8 Other Disorders of Muscle, Ligament, and Fascia	10 (1.85%)

PART IV: VARIATIONS IN VASRD AND ICD-9-CM CODING OF DISABILITIES OVER TIME

There have been temporal changes in the distribution of VASRD codes (Table 13). While the most common VASRD code has always been musculoskeletal conditions, the relative proportion of disability associated with musculoskeletal conditions has increased over time. Musculoskeletal conditions comprised 63% of disability cases from 1984-1989, 74% of cases in the early 1990s, and were up to nearly 79% from 1995 to 1999. Respiratory disability cases also increased as a percentage of total disability over time. Respiratory conditions comprised 3.8% of cases in the 1980s and increased too 4.4% of cases from 1995-1999. All other major VASRD categories decreased as a proportion of the total disability burden over time; most notably, mental health-related permanent disability discharges decreased from 4.9% of the total cases in the 1980s to 2.6% between 1995 and 1999; and cardiovascular disorders decreased from 8.7% between 1984 and 1989 to 2.2% of disability cases between 1995 and 1999. However, because mental health disability cases were least likely to have a corresponding CRO record, caution should be taken in comparisons of the relative proportions of cases by broad VASRD groups. It may be that increasing proportions of cases with CROs over the study period were predominantly occurring with in the musculoskeletal disability group and, thus, we have greater representation of those cases relative to mental health disorder and not necessarily smaller portions of mental health disability occurring over time.

Table 13. Proportion of disability cases by major VASRD group.

Category	Proportion of disability cases by era (% of VASRD Category over time) (% of total cases that era)		
	1984-1989	1990-1994	1995-1999
Musculoskeletal system (N=48,120)	15,441 (32.09%) (62.69%)	15,609 (32.44%) (73.85%)	17,070 (35.47%) (78.87%)
Mental disorders (N=2,615)	1,203 (46.00%) (4.88%)	856 (32.73%) (4.05%)	556 (21.26%) (2.57%)
Neurological conditions and convulsive disorders (N=4,180)	1,685 (40.31%) (6.84%)	1,332 (31.87%) (6.30%)	1,163 (27.82%) (5.37%)
Respiratory system (N=2,646)	933 (35.26%) (3.79%)	752 (28.42%) (3.56%)	961 (36.32%) (4.44%)
Cardiovascular system (N=3,271)	2,146 (65.61%) (8.71%)	667 (20.39%) (3.16%)	458 (14.00%) (2.12%)
Digestive system (N=1,143)	518 (45.32%) (2.10%)	344 (30.10%) (1.63%)	281 (24.58%) (1.30%)
Endocrine system (N=1,309)	697 (53.25%) (2.83%)	268 (20.47%) (1.27%)	344 (26.28%) (1.59%)
Infectious diseases, immune disorders, nutritional deficiencies (N=545)	274 (50.28%) (1.11%)	198 (36.33%) (0.94%)	73 (13.39%) (0.34%)
Eye (N=873)	481 (55.10%) (1.95%)	228 (26.12%) (1.08%)	164 (18.79%) (0.76%)
Skin (N=818)	409 (50.00%) (1.66%)	238 (29.10%) (1.13%)	171 (20.90%) (0.79%)
Genitourinary system (N=512)	261 (50.98%) (1.06%)	150 (29.30%) (0.71%)	101 (19.73%) (0.47%)
Ear and other sense organs (N=453)	237 (52.32%) (0.96%)	117 (25.83%) (0.55%)	99 (21.85%) (0.46%)
Hemic and Lymphatic Systems (N=302)	160 (52.98%) (0.65%)	82 (27.15%) (0.39%)	60 (19.87%) (0.28%)

Gynecological conditions and breast disorders (N=92)	34 (36.96%) (0.14%)	17 (18.48%) (0.08%)	41 (44.57%) (0.19%)
Dental and Oral Conditions (N=30)	16 (53.33%) (0.06%)	6 (20.00%) (0.03%)	8 (26.67%) (0.04%)
Missing (N=501)	137 (27.35 (0.56%)	272 (54.29%) (1.29%)	92 (18.36%) (0.43%)

Table 14 shows the top ten hospital diagnoses by era among Soldiers with a permanent disability discharge for all broad VASRD groups combined. Except for the introduction of asthma accounting for 3.2% of cases between 1995 and 1999, all of the most common ICD-9-CM diagnoses were musculoskeletal in nature and were consistently so throughout each era.

Table 14. Top 10 ICD-9-CM diagnoses by era—all VASRD groups.

Top 10 ICD-9-CM diagnoses					
1984-1989 N=9,514		**1990-1994 N-11,137**		**1995-1999 N=11,873**	
ICD-9-CM	N (%)	ICD-9-CM	N (%)	ICD-9-CM	N (%)
719.4 Pain in Joint	776 (8.16%)	719.4 Pain in Joint	1,478 (13.27%)	719.4 Pain in Joint	2,216 (18.66%)
724.2 Lumbago	677 (7.12%)	724.2 Lumbago	1,036 (9.30%)	724.2 Lumbago	1,692 (14.25%)
718.8 Joint Derangement, Not Elsewhere Classified	426 (4.48%)	715.9 Osteoarthrosis	375 (3.37%)	729.5 Pain in Limb	415 (3.50%)
717.7 Chondromalacia Patellae	354 (3.72%)	718.8 Joint Derangement, Not Elsewhere Classified	370 (3.32%)	493.9 Asthma, NOS	374 (3.15%)
716.1 Traumatic Artropathy	286 (3.01%)	717.7 Chondromalacia of Patella	322 (2.89%)	719.8 Other Specified Disorders of the Joint	308 (2.59%)
717.8 Other Internal Derangement of the Knee	224 (2.35%)	716.1 Traumatic Artropathy	309 (2.77%)	733.1 Pathological Fracture	282 (2.38%)
715.9 Osteoarthrosis	220 (2.31%)	717.8 Other Internal Derangement of the Knee	304 (2.73%)	718.8 Other Internal Derangement of the Knee	272 (2.29%)
734 Flat Foot	220 (2.31%)	729.2 Pain in Limb	249 (2.24%)	715.9 Osteoarthrosis	268 (2.26%)
729.5 Osteoarthrosis	219 (2.30%)	722.1 Displacement of Thoracic or Lumbar Intervertebral Disc w/o Myelopathy	224 (2.01%)	717.7 Chondromalacia of Patella	238 (2.00%)
715.3 Local Osteoarthritis, Unspecified	218 (2.29%)	734 Flat Foot	220 (1.98%)	722.1 Displacement of Thoracic or Lumbar Intervertebral Disc w/o Myelopathy	214 (1.80%)

The most common ICD-9-CM diagnoses among Soldiers who ultimately received a musculoskeletal disability varied slightly over time (Table 15), though pain in joint and lumbago were consistently the top two causes of musculoskeletal conditions throughout the time period. Between 1984 and 1989, joint derangement, along with pain in joint and lumbago, were the top three most common ICD-9-CM diagnoses associated with musculoskeletal conditions. From 1990 to 1994, osteoarthrosis was the third most common clinical diagnoses for those who ultimately received a musculoskeletal disability discharge, and by 1995-1999, pain in limb was among the most common top three diagnoses. All ICD-9-CM diagnoses associated with musculoskeletal disability through our entire study period remained with the clinical musculoskeletal category.

Table 15. Top 10 most common ICD-9-CM diagnoses for Musculoskeletal Conditions by era.

Era	ICD-9-CM Code (Number and Title)	Frequency and Percent
1984-1989	719.4 Pain in Joint	747 (11.12%)
	724.2 Lumbago	665 (9.90%)
	718.8 Joint Derangement, Not Elsewhere Classified	422 (6.29%)
	717.7 Chondromalacia Patellae	353 (5.26%)
	716.1 Traumatic Artropathy	282 (4.20%)
	717.8 Other Internal Derangement of the Knee	224 (3.33%)
	734 Flat Foot	217 (3.23%)
	715.3 Local Osteoarthritis, Unspecified	214 (3.19%)
	715.9 Osteoarthrosis, Unspecified	208 (3.10%)
	722.1 Displacement of Thoracic or Lumbar Intervertebral Disc w/o Myelopathy	177 (2.64%)
1990-1994	719.4 Pain in Joint	1,435 (16.32%)
	724.2 Lumbago	1,016 (11.55%)
	715.9 Osteoarthrosis, Unspecified	370 (4.21%)
	718.8 Joint Derangement, Not Elsewhere Classified	366 (4.16%)
	717.7 Chondromalacia Patellae	320 (3.64%)
	716.1 Traumatic Artropathy	304 (3.46%)
	717.8 Other Internal Derangement of the Knee	300 (3.41%)
	722.1 Displacement of Thoracic or Lumbar Intervertebral Disc w/o Myelopathy	224 (2.55%)
	734 Flat Foot	215 (2.44%)
	729.5 Pain in Limb	212 (2.41%)
1995-1999	719.4 Pain in Joint	2,196 (22.98%)
	724.2 Lumbago	1,677 (17.55%)
	729.5 Pain in Limb	394 (4.12%)
	719.8 Other Specified Disorders of the Joint	304 (3.18%)
	733.1 Pathological Fracture	281 (2.94)
	718.8 Joint Derangement, Not Elsewhere Classified	269 (2.81%)
	715.9 Osteoarthrosis, Unspecified	266 (2.78%)
	717.7 Chondromalacia of Patella	237 (2.48%)
	722.1 Displacement of Thoracic or Lumbar Intervertebral Disc w/o Myelopathy	212 (2.22%)
	734 Flat Foot	183 (1.91%)

DISCUSSION

For many of the VASRD groupings, the corresponding ICD-9-CM diagnoses demonstrate good face validity. That is, the most commonly assigned ICD-9-CM codes are consistent with the given VASRD condition group. However, in some cases the clinical diagnoses do not appear to be directly associated with the primary VASRD disability code. For example, while most cardiovascular disability cases have a corresponding clinical diagnosis that logically relates to cardiovascular disease, it is curious that the top second and third diagnoses from the CRO records for Soldiers ultimately discharged with a primary VASRD code of cardiovascular disability were related to neurological and/or musculoskeletal disorders. Pathological fractures and pain in limb were historically used to code stress fractures (in the absence of any other code) and also sometimes used to indicate bone cancer. It is unclear why it would be such a common diagnosis among Soldiers ultimately discharged with cardiovascular disease. It may be that the same factors, for example, elevated cholesterol or obesity, that contribute to fractures may also increase risk for cardiovascular disease. Still, we would have expected pain in limb to be more closely associated with the musculoskeletal disability group. It may be that musculoskeletal disability is so common that it is a common secondary condition or morbidity even among those discharged primarily for another cause of disability. The order for listing disability conditions (there can be up to four VASRD codes assigned to the disabled Soldier) may reflect significance or severity of the specific disabling condition and/or amount of compensation associated with that condition. Because these analyses use only the primary VASRD code and the primary ICD-9-CM code, this may explain the presence of what appear to be musculoskeletal disorder diagnoses in hospital records for Soldiers discharged primarily for cardiovascular disease disability.

Extreme heterogeneity within some VASRD groups, such as infectious, immune, and nutritional disorders; hemic and lymphatic systems; and gynecological and breast disorders, and within the underlying clinical diagnoses associated with these conditions substantially impede the utility of these data for surveillance and research purposes. While the actual ICD-9-CM codes associated with these broad VASRD groups were not inconsistent with the types of conditions that one would expect to find in these categories, the widely differing etiologies of these conditions suggest combining them makes little sense from a clinical perspective and also renders each of these broad disability groups or categories of little use for research purposes. Given the different etiologies of infectious diseases versus autoimmune disorders, the infectious disease, immune disorders, nutritional deficiency VASRD group, in particular, may be among the most eclectic in its composition.

The gynecological and breast VASRD group also poses some problems, at least with regard to meaningful interpretation of findings using this VASRD group. Though most of the clinical conditions linked to the gynecological and breast disorder VASRD group are diagnoses usually specific to only women, not all are. For example, men can have neoplasm of the breast and abdominal pain. It is not clear where male neoplasm of the breast would be coded in the VASRD system. Similarly, it is not clear where

abdominal pain for men, the fourth most common clinical diagnoses within the gynecological and breast disability VASRD group, would be coded under the VASRD system. It might be placed within the diseases of the digestive system disability group if it led ultimately to a compensable long-term problem. Another challenge, in addition to the apparent tendency to lump any condition common to women in this VASRD group (whether it actually pertains only to female reproductive system or not) is the variation in the type of conditions listed. The conditions included in this VASRD group vary both by body part or system affected and etiology. These variations suggest caution should be used in interpreting the significance of gynecological and breast disability disorders and in comparing the incidence of some types of disability (e.g., abdominal pain) among male and female Soldiers. Consideration should be given to revising this VASRD category to improve clinical clarity.

Care should be taken when trying to analyze any of these three heterogeneous VASRD groups because of the diversity of underlying clinical diagnoses represented within these broad VASRD disability categories. To improve utility and clinical relevancy, this VASRD group should be changed to at least separate infectious from other disease processes. More research and disability coding policy change is suggested by these findings. Researchers focused on these types of conditions will need to conduct analyses at a more refined subcategory level, rather than working with the broad VASRD group. Furthermore, because some of the conditions coded as gynecological and breast conditions may not, in fact, be truly gender-specific, care should be taken when comparing male and female rates for some conditions (e.g., malignant neoplasm of the breast, abdominal pain).

Musculoskeletal conditions are the most common type of permanent disability discharge from the U.S. Army and have been for over two decades. What's more, disability related to musculoskeletal conditions has increased as a proportion of the total disability burden over time. By identifying the most common ICD-9-CM diagnoses experienced by Soldiers who eventually receive musculoskeletal disability, we can target such conditions and incorporate them into intervention planning efforts. The primary clinical conditions experienced by those hospitalized and ultimately discharged from the Army with a musculoskeletal disability condition were pain in joint, lumbago, joint derangement, chondromalacia patellae, and osterarthrosis. These are all diseases of the musculoskeletal system and connective tissue (710-739). There are a number of risk factors for these conditions including acute injury and body composition factors, such as greater body mass index (BMI) and stature (very tall or very short). The high incidence of knee- and back-related disorders may be indicative of occupational exposures, such as high-impact physical training or job demands (17, 18, 21, 30), or heavier BMI or overweight (11, 15, 23, 24, 26, 29, 32).

Joint pain, or arthralgia, was the most commonly assigned primary diagnosis among Soldiers discharged with a musculoskeletal disability. Joint pain may result from a number of causes and reflect a number of different underlying clinical conditions including, arthritis, osteoarthritis, gout, fibromyalgia, autoimmune disorders such as lupus, bursitis, tendonitis, and acute injury or trauma (16). This is also a common diagnosis within the general population. It is associated with increasing age and is

more common among women than men. Studies also suggest that joint pain is commonly reported among Gulf War Veterans. Joint pain was the most common complaint reported by participants in the Comprehensive Clinical Evaluation Program for Gulf War veterans in 1995. In addition, it was the most common ICD-9-CM diagnosis within the musculoskeletal conditions group for Gulf War veterans (8, 20, 31).

Lumbago, or unspecified low back pain, was the second most commonly occurring ICD-9-CM diagnoses among Soldiers with a CRO record who were discharged from the Army with permanent disability. Lumbago was also the second most frequently identified ICD-9-CM condition within the ICD musculoskeletal group among Gulf War veterans (8). Causes of lumbago may be acute trauma or residual pain from old injuries (e.g., after lifting something heavy or overuse), or it may often have an unknown etiology. Two of the top ten conditions are back-related diagnoses and two are related to knee pain or injury. Because other diagnoses are nonspecific with regard to body part, it is possible that some of these other nonspecific joint pain or osteoarthrosis conditions may also involve the knee or back. This is important clinical information that should be used to guide future analysis of musculoskeletal disability risk factors.

Arthritis and periostitis were common diagnoses within the musculoskeletal disability group. These involve inflammation around joints or of the tissue that is wrapped around bones (inflammation around the bones). Sometimes the latter is called shin splints if it affects bones of the lower leg. While there is not enough data yet to formulate theories regarding the increasing incidence of musculoskeletal disability, it does appear that much of the growing problem of disability is related to overuse and possibly acute injury to the back, knee, and possibly other joints. There are a number of hypotheses that could be tested to help clarify the etiology of this increasing disability problem. Changes in occupational exposures, for example, may be contributing to an increased risk for knee and back problems. The advent of better protective gear may save lives during battles and crashes, for example, but may also have the unintended consequence of increasing stress on the spine or lower extremities and ultimately contribute to musculoskeletal disability (3). A more rigorous physical fitness training program, as well as improvements in medical care management and possibly diet may have resulted in lowered risk for cardiovascular disease, but perhaps the primary aerobic training methods (marching, walking, running) have contributed to knee and back disability. Finally, in the civilian sector, obesity and body mass have increased over time (12, 27). Within the military population, there have also been increases in BMI concurrent with an apparent increase in some measures of strength (grip strength has increased over time), but no improvement in muscular endurance (number of situps and pushups in 2-minute timed interval) and possible decrease in aerobic fitness (run time) (19). Both body fat and fat-free mass of male Army recruits have increased over time, while data on female recruits was more variable. Thus, many of the underlying clinical conditions associated with the rapidly growing musculoskeletal disability group reflect problems that often are consistent with bearing heavier weight or being overweight, and with exercising too much and/or exercising while bearing too much weight. Future work should attempt to test these hypotheses.

Only musculoskeletal disability and disability related to respiratory conditions increased over the study period. By far, the fastest growing and largest category of disability was musculoskeletal disability, but the addition of Asthma to the most common diagnoses list in the latter part of the study period is worth noting. This may simply reflect an increase in screening and/or case-finding, or it may reveal a pattern of increasing incidence of asthma as a co-morbid condition. An increase in asthma has also been similarly documented in the general U.S. population (13, 25).

Musculoskeletal disability comprises about 2/3 of the entire disability population. While it has always been the largest disability group, it has grown as a relative proportion of all disability over time. The major subcategories of musculoskeletal disability are labeled “Injury” and “Disease,” with “Injury” occupying a somewhat larger position (55% versus 44% of musculoskeletal conditions, respectively). Despite the distinction in category labels, both “Injury” and “Disease” musculoskeletal conditions primarily describe or capture clinical conditions within the 710-739 range (Diseases of the musculoskeletal system and connective tissue) section of the ICD-9-CM codebook. This may reflect that fact that sequelae of acute injury are essentially “chronic” conditions by the time someone is discharged from the Army, and a label of “Injury” may reflect the etiology of the condition better than the nature of the condition. Thus, it is not clear how meaningful subcategory analyses of the musculoskeletal conditions would be.

STRENGTHS AND LIMITATIONS

The most significant limitation to this study is the lack of disability-evaluation-related hospital record data on all individuals who are eventually discharged from the Army with a permanent disability. Furthermore, the phasing out of CRO records also may limit generalizability of findings to more recent disability cases. Despite this limitation, analysis of the demographic composition of those with and those without a CRO suggest that the populations are quite similar; there is not evidence of possible bias with regard to demographic characteristics. There are some interesting differences with regard to the types of disabilities that receive a CRO record, with mental health disorders being notably less likely to have a corresponding CRO record.

Second, in order to make this analytic effort manageable, we focused on primary ICD-9-CM clinical diagnoses and on the primary (first) VASRD code. Thus, it is possible that we are missing important linkages or patterns between certain clinical conditions and certain VASRD codes. We may miss, for example, common comorbidities. On the other hand, the consistency between ICD-9-CM diagnoses and primary VASRD groupings suggests that this approach is reasonable for the purposes of assessing how well VASRD group maps to clinical group. Future research efforts would benefit from greater exploration of secondary clinical diagnoses and secondary disability groupings.

Despite these limitations, this study was still able to provide a detailed picture of how ICD-9-CM clinical diagnoses relate to disability discharges. Our ability to link hospital data with disability data at the individual level is a unique strength of this study.

Using the TAIHOD database, we were able to study a relatively large sample of Soldiers over a 25 year period, with hospital records available for 32,524 Soldiers who eventually received a permanent disability discharge from the Army.

CONCLUSIONS

This report describes the association between VASRD disability codes and clinical diagnoses assigned during disability-related hospitalizations. The most common ICD-9-CM diagnoses varied, as expected, by broad VASRD groupings. Overall, the diagnostic categories most common in disability-related hospital records generally link in a logical way to the broad VASRD categories assigned in a discharge for permanent disability. However, for some VASRD groups, such as infectious disease, immune disorders, nutritional deficiencies; hemic and lymphatic systems; and gynecological and breast problems, there is a lot of variation in the types of clinical conditions included. This extreme heterogeneity may make these VASRD groups less clinically interpretable when analyzing trends, or when using these groups as part of a larger surveillance or epidemiological research effort. In addition, consideration should be given, from a policy-level, to revising and modifying these VASRD categories and for inclusion of ICD-9 CM diagnostic codes in the PEB disability database, especially since they are readily available to the PEB record system already. They were initially excluded because of space considerations and data storage limitations. However, with the advent of much more efficient computers with substantial storage capabilities, this no longer appears to be a salient argument for excluding the diagnostic codes.

Musculoskeletal disabilities are the most common cause of disability among Army Soldiers, and low back pain (lumbago) and joint pain comprise a majority of the underlying clinical diagnoses. These clinical diagnoses were consistently among the most common throughout the entire study period. The increasing risk for musculoskeletal disability suggest that more research is needed to understand underlying risk factors for these conditions and, in particular, why the risk is increasing. The hypotheses described above should be tested, in particular whether or not increasing BMI may explain, in part, the increased risk for musculoskeletal disability.

The ability to link disability-related hospitalizations to VASRD codes assigned in a permanent disability discharge can inform research and allow a better understanding of the natural history of disability within the Army. Future efforts should focus on assessing the face validity of more current VASRD codes perhaps by linking to the MEBITT data or other sources of information on clinical diagnoses associated with disability cases. Research on the link between secondary or comorbid clinical conditions and specific VASRD primary and secondary codes is also warranted.

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